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*SOME FEATURES OF AMERICAN HIGHER EDUCATION.**

THE first characteristic, then, of our American system of higher education is the hearty cooperation of state, church and private effort in the work of founding and developing a group of institutions which taken as a whole should supply the need of higher training. And the educational welfare of the country demands that this cooperation shall continue, at least for an indefinite time to come.

We, as a people, cannot afford to let the interest of the state, of the church, or of private individuals in higher education languish or die. It is a striking testimony to the essential oneness of the American people, to the essential soundness of our educational life that all these different institutions are working consciously toward the same ends; that the fundamental qualities of American citizenship are developed in all alike and that the ideals of all these various institutions in this respect are the same. The alert, wide-awake, conscientious, devoted lover of his country and his kind, the prudent, painstaking, truth-loving scholar is the product of all alike.

Another peculiarity of American universities distinguishing them from their

* From the inaugural address of Dr. Edmund J. James as president of Northwestern University, given on October 21, 1902.

European counterparts in a very striking way is the form of government—the non-professional, non-expert board of trustees. English institutions of higher learning are in the control of their faculties or their alumni or both with now and then in certain cases a cooperation in appointments by the government. On the continent they are nearly universally under the control in many important respects of the governmental departments of education with certain cooperation on the part of the faculty.

With us they are nearly all, legally at any rate, entirely under the control of a body outside of the faculty, outside of the alumni and outside of the state departments of education. Even the state universities are usually directly under the control of a special board appointed for this particular purpose and not subject in any other way to the regularly constituted state authorities. These boards are either —as in the case of state universities—appointed by the governor or elected by the legislature or the people, or appointed by the church, or more often are self-elective, filling vacancies in the board by the votes of the board itself. These trustees are often business men, sometimes not college graduates themselves; often professional men—nearly always men who have had no other connection with educational work than that involved in their duties as trustees.

To these boards is entrusted by law full authority to prescribe courses of study, to appoint and dismiss professors at pleasure and to prescribe their duties in detail if they so desire. The foreign student looks at this delegation of one of the most important functions of society to a set of busy men who cannot be expected to have expert knowledge of the subject with amazement not unmixed with amusement.

Does it not often happen he says that an ignorant trustee, imagining that he knows more about the business than the faculty, interferes like a bull in a china shop, disarranging the machinery, bringing everything to naught by his ignorance, his officiousness and his obstinacy? What good do they do anyhow? How can you check their pernicious activity?

Well, we have all heard of such trustees —perhaps we have known such individuals personally, not in our own institutions, of course, but in others. The trustee who thinks the faculty is made up of men trying to get the largest possible salary for doing the least possible work, and who regards it as his duty to see that they do the largest possible amount of work for the least possible remuneration; the trustee who undertakes to pass upon each individual item of college business as if he were the expert and the faculty the mere employee to carry out his plans. The existence of such a person I shall not undertake to deny; the existence of whole boards of such trustees is at least possible logically speaking and certainly the fancied knowledge of the practical man can assume most offensive and irritating forms—dangerous in proportion to the ignorance and obstinacy which lie behind it. I think it is highly probably that if we were blocking out anew in an old civilization a method of government for higher institutions of learning no one would think of resorting to such a device as that of a non-expert board of trustees as the chief organ of control.

But to-day through the evolution of American conditions we have elaborated such an organ and to my mind this fact has had a profound significance for our educational life.

Universities tend to become caste and class institutions. They tend to become pharisaic in sentiment and action. As self-governing bodies, if they have great endow-

ments they learn to regard themselves as existing primarily for the benefit of the people who happen to be in control at the time. English educationists tell us that such were Oxford and Cambrdge at one time in their existence; such were nearly all the continental universities wherever they secured complete autonomy and control of adequate foundations.

The absolute governmental control of universities on the continent to-day was necessary in order to rescue them from the dry rot which universally sets in where they are purely self-governing bodies.

If higher institutions of learning are to serve their real purpose they must at some point be brought under the influence of public opinion; they must come in contact with the daily life about them. Some means must be provided by which the life blood of the great pulsating world around them can flow in and through them, purifying, cleansing and purging them. Some common organ must be developed which can bring the university and the world of outside activity together. This end has been attained in our American device of boards of trustees and I believe that a large part of the extraordinary development of our higher schools is due to the fact that through these boards of trustees it has been possible to bring outside influences to bear on the internal management and spirit of these institutions. All this is aside from the very significant fact that they have been most important elements in securing that public interest which has turned such streams of wealth into the treasuries of our schools without which our recent progress would have been impossible. All this is aside, moreover, from the fact that many of these trustees have themselves provided the necessary funds out of their own resources.

When we add to this the circumstance that these trustees have often brought to the university in the management of its business affairs a devoted service which could not have been bought for any money you can readily realize what an important part in this magnificent development has been taken by the hundreds and thousands of public-spirited men who have at great expense of time and effort given their best services to this cause. I may add that in my own opinion such boards perform a most valuable additional service in that they offer an opportunity to have every question of general university policy submitted to the bar of an earnest, sympathetic impartial jury, before undertaking any comprehensive changes.

Another unique institution characteristic of our American system of higher education is that of the presidency. The American university president has no exact counterpart in the educational scheme of any other country. He is a development peculiar to the United States, an outgrowth of peculiar educational and financial conditions. He is theoretically supposed to be an educational leader, a financial leader and a practical business manager combined in one. He is not only expected to outline an educational policy in a broad way, but also to keep *au fait* with the educational administration of the university even into its very details. It is ordinarily made his duty to enforce the rules and orders of the board of trustees and see that every instructor is performing his duty toward the institution and the students.

He is expected, moreover, to plan a scheme of financial support for the institution and devise methods of keeping its needs before the public. If he is president of a state university he must know how to impress the legislature; if of a private university he must be able to get the attention of the church or of private individuals who are able to contribute to the endow-

ment or current support of the institution. He must also see that this money once obtained is wisely spent. He must be able to prepare a budget in which security is offered for the wise expenditure of every dollar and that the total outlay be kept within the total income. In many cases he must, furthermore, supervise and be generally responsible for the actual administration of the business affairs of the university.

In the public mind, at any rate, he is entrusted with responsibility for all the details of discipline, from providing safeguards against the silly pranks of freshmen or the wild excesses of upper classmen engaged in celebrating athletic victories, to determining the attitude of the institution toward fraternities and sororities.

In fact, the position in its functions and responsibilities has become an almost absurd one. No man, however able, however experienced, can possibly perform all its duties. I have had the rare good fortune to work in the very closest relations with two of the ablest university presidents whom this country has ever produced—remarkable not only as educational leaders of the first rank but as men of extraordinary powers for general effectiveness in anything they undertake—Dr. William Pepper, late provost of the University of Pennsylvania, the ablest native-born citizen of Philadelphia, a man of extraordinary insight and far-reaching mental powers, and President William R. Harper, whom you all know as facile princeps in this field. I have known several other able university presidents and I am sure that I am not reflecting upon their ability or their good will when I say that I have never known a university president who fulfilled even approximately the functions which his position theoretically placed upon him; for the simple reason among others that it transcends human ability.

I need not say that I have no hopes of succeeding where these men and such as they have failed. I mean by failing that they failed to do the things which the logic of their positions forced upon them; which under the circumstances nobody else could do; which they had no time or strength to do and which, therefore, went undone.

I believe the time is rapidly approaching, if it is not already here, when this office must be put into commission; when its functions shall be separated and when the duties now entrusted in theory to one man will be divided among several.

The office, as said before, is an outgrowth of our peculiar educational conditions and will probably disappear in its present form when we pass from the pioneer to the settled state of society.

More than one foreign critic has remarked upon the strange forces which in a republic have evolved such an anomalous officer—strangest of all in the republic of letters and science—an officer with vague but real powers of discipline over faculty and students—chosen not by faculty or students but by an outside and irresponsible body—the anomalous organ before referred to—the board of trustees. Somebody has defined the government of Russia to be a despotism tempered by assassination. Somebody else has remarked that this is almost an exact description of the government of an American college or university. The president of the institution backed up by the board of trustees can drive out not only any particular professor but an entire faculty or several faculties—such an occurrence is not unknown in our educational history. The president keeps on in his course of change—reformation or deformation as the case may be—until the rising tide of opposition finally overwhelms

him and a new experiment is made with another man. The comparison of the function of an American university president with that of a king or despot, is, however, an unfortunate and misleading one. Much more illuminating would be the comparison with the responsible head of an English cabinet. As long as he proposes plans which command the assent of his board of trustees—representing in this case the parliament—the lawgiving authority—he is all powerful. He has behind him the entire force of the country so to speak. He can build and rebuild; extend and contract; raise up and cast down. But the instant he loses the confidence of this board for any reason, good or bad, his power is gone; his position becomes untenable. He goes to join the ever-lengthening list of ex-ministers always willing to criticize, always willing to give their advice and counsel.

The American system of higher education would probably never have developed with such astonishing rapidity if it had not been for these two peculiar organs of life and expression—the trustees and the president; but it is hardly conceivable that either of them is destined permanently to play such an important part in the educational economy of the country as they have done in the past and are doing now.

If time permitted, I might discuss many other interesting peculiarities of the American system of higher education which distinguish it from its counterparts in other countries; but I must content myself with a mere glance at one or two other aspects of it.

Our American system of higher education is evangelistic in character. Our institutions—at least in the last generation—have never been satisfied with merely offering their facilities to the public, content to let those who wished such opportunities avail themselves of them. They have gone forth into the community in one form or another and preached the gospel of a higher education; they have gone out into the highways and hedges and compelled the guests to come to the feast which has been prepared for them. They have all engaged in this form of university extension work and the result is seen in the ever-rising tide of university attendance. We have, generally speaking, in this country not compelled attendance at universities as they do on the continent. We have not made attendance at a university a condition of admission to the bar, to the church, to medicine or other professions or callings. We have left it free to our young people to attend these institutions or not as they saw fit. What the government has failed to do in this respect, private parties must do for it, if the standards of education and culture are to keep pace with our growing wealth and population. Hence the willingness on the part of our higher schools to preach this doctrine of the desirability, nay, necessity of university training.

This campaign for higher education—we can really call it nothing else—takes on different forms in different parts of the country. The president in a small college not a thousand miles from Chicago told me of a missionary tour he made one summer which doubled the attendance at his college. He hired a large covered wagon and a strong team of horses for three months. He loaded in his college glee club and a few cooking utensils and started across a section of country from which as far as he could learn no candidates for any college had ever emerged. He would drive into a village, tether his horses and making arrangements for food and drink begin his campaign. The glee club would sing a series of all-compelling college songs on the space in front of the wagon or on the village green. After a suitable crowd had

gathered the president would deliver an address on the desirability of a higher education. This would be followed up by a meeting in the church or churches, by an address before the town schools, etc., etc. Before he was through with his three days' meeting the whole town was as excited on the subject of colleges and universities and higher education as it was in the habit of becoming only over politics and religion.

This may be a somewhat crude form of preaching the gospel of higher culture, though it was doubtless effective. It is the salvation army plan of getting into the educational depths. The greater institutions have pursued more subtle methods—oftentimes with even greater effect. The system of accrediting schools with the periodical visitation by a member of a university faculty; the system of affiliating schools and making them to feel themselves a part of the university—thus leading many youths to look toward higher schools who would not otherwise have thought of it; the building up of great alumni associations with one of their chief objects the increase of attendance at alma mater; the publication of alumni magazines and semi-scientific periodicals of various kinds; the sending out of news letters to the press; the organization of university extension work in all its various forms; the trips of the college associations like glee clubs, football elevens and baseball nines, intercollegiate debates, the annual tours of university presidents through the country, the offering of scholarships and fellowships, etc., etc., all contribute to the same end of popularizing the university and of accomplishing by different methods and methods more consonant with our American life the same end of bringing large numbers of people in contact with higher education as the compulsory methods of European countries do for them.

Some critically inclined people have called this evangelistic work by the cruel term of advertising, and have denounced it as unworthy the institutions and educational policy of a great country, have referred in scathing terms to the strenuous competition of our universities and colleges for students. Such a conception fails to grasp the vital elements in the situation.

The whole movement has undoubtedly assumed the form of a strenuous competition. It would, of course, be easy for such a strife to degenerate and to assume a ruinous and destructive form.

But the actual fact is the contrary. And this leads me to the further proposition in regard to our American system of higher education; viz: that it has been characterized during the past fifty years in all its parts by an earnest desire for improvement in every direction. Our institutions have competed with one another in improving their facilities, striving to see which one could offer the best libraries, the best laboratories, the most learned and skillful teachers, the best opportunities for physical culture, the best chance for an all-round, well-developed manhood and womanhood. And the story of advance along this line is marvelous.

They have competed with one another in raising their standards of admission and their requirements for graduation until now many of our able educators think that this progress has gone too far, that we are making unreasonable requirements for admission to college, for graduation from college, for admission to graduate work and for the higher degrees.

This competition has been along the very highest times. It has led, as modern competition so often does, to various forms of cooperation. Our higher schools have united for common action on many things. They are rendering service to the secondary

schools by helping to fix their standards and maintain a high quality of work.

Another peculiarity of the American system of higher education is the unparalleled extent to which it provides for the education of women. No system of higher education in any country at any time has ever made such liberal provision for the higher education of women as our own. This has taken different forms according to the local conditions prevailing in different parts of the country. In the state universities as might be expected it has assumed the form of coeducation in the fullest sense of the term—absolute equality and similarity of treatment of both sexes in all respects, practically no recognition that either sex requires or would care for any special provision for its peculiar wants or needs. In the Mississippi Valley most of the church institutions and other schools under non-state control have, naturally enough, followed the example of the state universities, and established as a principle anyhow the complete parity of the sexes in higher education.

In the east the older universities like Harvard, Yale, Columbia, Pennsylvania, etc., have adopted a somewhat different plan. Starting as a mere scheme of private tutors for women under a certain supervision of the university, these plans have worked out into a system of women's colleges affiliated with or annexed to the university in which many of the facilities accorded to the men may be enjoyed by the women. And finally the system of women's colleges, pure and simple, has been elaborated which beginning with Vassar now numbers east and west more than half a dozen institutions of the first rank of which we may well be proud.

What the ultimate form of female education is to be in this country I think no wise man would venture to predict with any confidence. It is safe, however, to say that in all probability the various forms now in existence will continue to flourish and other forms may be added as our society develops. The typical form, however, that which will ultimately embrace the vast majority of institutions and students will be, in my opinion, for a long time to come at any rate in the Mississippi Valley the system of coeducation, simple, complete and unadulterated; if for no other reason, for the simple one that for the complete education of women as our American society conceives it the entire range of educational institutions must be provided and for a long time to come we shall not be able financially to build and maintain two entirely different systems of education, one for women and one for men. Nor, I may add, will such a duplication of educational faculties ever be justified by the fancied evils of coeducation.

There is still another feature of our American system of higher education which ought not to be omitted in even a cursory view of the subject. That is the peculiar way in which we have combined the work of technical instruction with that of the humanities and the professions in one institution. We have united, to use a German term, the Polytechnicum and the university. This has had a marked effect upon instruction in both branches of the institution. The technical school has made university work more practical, compelled it to measure itself by new and healthful standards and brought a new spirit into much of its activity. The university has humanized the technical work.

A technical school bodies forth in its very aim and spirit an idea which is at times in danger of being lost in the pursuit of pure science and the humanities, viz: that the ultimate test of all knowledge is being good for something besides itself.

The presence of the professors of technical subjects in a faculty where all other subjects of college and university instruction are represented has proved to be a healthful and inspiring influence. Contact with the culture side of education has in its turn reacted upon the technical instructors and thus the way is paved for a mutual action and reaction of these two great forces in education much to the benefit of both and to the lasting improvement in spirit and method of every grade of American education. I am aware that some acute critics of American education have lamented this very fact. But it seems to me that their view of education is erroneous. It is not necessary, as has been well said, by one of our great scholars, that every man in the community should study Latin and Greek for ten or twelve years; it is not necessary that every man should have an adequate conception of Greek and Roman civilization. It is very necessary, however, to national welfare that some members of our society should give time and attention to these things; that some scholars should give strength and power to the mastery of this ancient civilization and thus interpret for our day and generation the imperishable experiences of Greece and Rome, live over for us their history and be able to rewrite and reinterpret it for us all.

Now there has never been a time in this country when the facilities for the study of the humanities have been greater, or the ardor in their pursuit more intense than to-day. Never has the study itself been more practical and useful than at present. And it seems to me apparent that the very emphasis which pure and applied science has received in our modern educational system by the union of technical school and university has made its contribution to the revolution in the study of the humanities which has marked the last generation in this country. Technical students leave our universities defenders of the importance of the study of the humanities—a justification in itself of the union of the polytechnicum and the university.

As a result of all these things and many more which time does not permit me to discuss I believe that the American system of higher education is nearer to the people, commands more completely their sympathy, is better understood by them and consequently more admired and loved than ever before.

The general public is far more interested in everything relating to our colleges and universities; our newspapers give more space to chronicling the events in the academic world, take a livelier interest in the discussion of college and university policy than ever before. All these things point to the firm hold which this department of education has taken of the average man, developing in him an interest in and affection for our higher institutions which argues well for their future.

And this has come about among other things because we have secured the cooperation of state, church and private initiative, thus bringing in all classes of the community; because we have secured a close contact with the community in our very scheme of organization because our institutions have conceived it to be a part of their duty to beget by conscious activity an interest in the great public for their work; because we have cared for the education of women and thus enlisted the support of an enormously large and ever more important element of our society; and because we have emphasized the great departments of applied science in our scheme of higher education as well as the traditional training for the learned professions.

I cannot let such an occasion as this pass

without thanking you one and all for your presence here. I am well aware that it is no personal testimonial to me. Many of you I have met to-day for the first time and although I shall hope to have many opportunities of cultivating an acquaintance so pleasantly begun yet it is possible that many of us may never meet again.

Your presence here, however, is a testimony to the essential oneness in aim and in spirit of our American institutions of higher learning; it is an evidence of sympathy and good fellowship; it is earnest of cooperation and emulation for all good things.

We who are gathered together here as students, professors, trustees, benefactors, friends, of American colleges and universities may congratulate ourselves. We have surely followed Emerson's injunction and hitched our wagons to the stars. Every one of us may be glad that it has been permitted to him to take a part, however humble, in the great work of laying the foundation and erecting the superstructure for a series of institutions from the Atlantic to the Pacific, from the Great Lakes to the Gulf, which shall do for us and our civilization what the universities of the Old World have done for Europe.

Surely we may rejoice if we can help to win for our country the same proud position in education and science which our fathers and brothers have won for it in industry and commerce.

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*ON THE POSITIONS OF THE NORTHERN CIRCUMPOLAR STARS.**

THE importance of knowing the positions of the fixed stars has been recognized from the time of the early Greek astronomers, and the accuracy demanded has increased with the progress of the science. During the past two hundred years an enormous amount of labor has been expended in forming catalogues of the stars, and further progress in this direction is recognized to-day as one of the principal needs of astronomy. Not only ought a larger number of stars to have their places accurately measured, but the positions of many of the so-called fundamental stars should be more precisely determined.

Since the motions of the Sun, Moon and larger planets are confined to the region of the sky known as the Zodiac, the equatorial and zodiacal stars have been more frequently observed and their positions more accurately determined than is the case in general with the circumpolar stars. Comparison stars are needed near the pole only on those rare occasions when a comet crosses that region of the sky.

Beginning with the epoch-making observations of Bradley about one hundred and fifty years ago, the work of determining fundamentally, that is with reference to the equator and equinox, the places of a limited number of equatorial and circumpolar stars has been carried on continuously at Greenwich. Since its foundation about 1840, work of the highest value has been done by the National Observatory of Russia at Pulkowa, near St. Petersburg. Fundamental work of this kind has also been done at various other observatories, mostly European, and by professional astronomers, notably by Bessel and Struve.

Valuable differential work on the circumpolar stars has been done by amateur astronomers, whose work has been based on the positions of fundamental stars previously determined. Some of the noblest examples of devotion to science are found in the history of this subject.

Perhaps the most remarkable case is that of Stephen Groombridge, a linen draper of London, who about 1802 set up a transit circle by Troughton of three and one half

* Paper read before Section A, American Association for the Advancement of Science, Pittsburgh meeting, 1902.

inches aperture and five feet focal length at Greenwich, near the Royal Observatory. Groombridge labored for several years in observing the stars of the northern heavens. After his death in 1832, the reduction of these observations was superintended by Airy and a valuable catalogue of 4243 stars reduced to 1810.0 was formed. Airy pronounces the work 'one of the greatest which the long-deferred leisure of a private individual has ever produced.' This catalogue is not exclusively circumpolar, as many stars of forty or even fifty degrees of north polar distance are included. The Groombridge stars were reobserved by Johnson at the Radcliffe Observatory of Oxford University during the years 1840 to 1853 and the results form a part of the Radcliffe Catalogue of 6,317 stars for 1860.0. More than 85 per cent. of the Groombridge stars were observed at Greenwich during the years 1887 to 1896, and are contained in the second Greenwich 10-year Catalogue for 1890.0.

Another useful piece of amateur work is the Redhill Catalogue of 3,735 circumpolar stars for 1855.0 by R. C. Carrington, an astronomer otherwise well known for his work on the sun. His observatory was situated at Redhill in the southern suburbs of London, and his instrument, now at the Radcliffe Observatory, Oxford, was a transit circle by Sims of 5 inches aperture and 66 inches focal length. Carrington extended the zones of Bessel and Argelander from 80° north declination to the pole. It was his intention to observe all stars within this region down to the tenth magnitude. In the introduction to the catalogue Carrington states 'I will establish the rule that of the class of stars included in my plan, none shall be excepted from sufficiently repeated observation,' and this resolution seems to have been faithfully carried out.

Another work of importance is that of F. M. Schwerd, a professional astronomer of Speyer in Rhenish Bavaria, not far from Heidelberg. Schwerd observed, during the years 1826–8, 1,397 stars within fifteen degrees of the pole, with a small but '*vortreffliche*' meridian circle by Ertel of 1.7 inches aperture and 42 inches focal length. The divided circle was 20 inches in diameter and the power of eye-piece used was 126 diameters. Schwerd's observations reduced to 1828.0 were published by Wilhelm Oeltzen, of Vienna, in 1856.

The observations of circumpolar stars by Lalande at the Paris Observatory have been collected into a catalogue by Fedorenko, of Pulkowa, which, like the catalogue of Groombridge, contains many stars forty degrees or more from the pole. This catalogue contains 4673 stars for 1790.0.

A valuable recent work is the catalogue of 123 circumpolar stars for 1893.0 by M. Ditchenko, of Pulkowa. The stars of this catalogue are all within ten degrees of the pole and mostly of the 7.0 magnitude or brighter. The observations were made with the Repsold Meridian Circle of the Pulkowa Observatory and are differential, being based on the nine fundamental circumpolar stars of the *Berliner Jahrbuch*. The stars have been observed from four to six times each.

During the past twenty years good differential work on the circumpolar stars has been done in the United States with Repsold meridian circles at the Williams College Observatory, Williamstown, Mass.; at the Washburn Observatory, Madison, Wis.; and at the Lick Observatory. A few observations of circumpolar stars on a fundamental basis have within recent years been made at the Naval Observatory in Washington, but very little really fundamental work on the fixed stars seems to have been done in this country.

Dr. Auwers, of Berlin, published in 1897 (see *A. N. Nr.* 3440) a list of 21 circumpolar stars, with a request for observations

with a view to increase the number of well-determined stars near the pole. The great scheme of the *Astronomische Gesellschaft* of Leipzig for observing the stars of the northern heavens down to the ninth magnitude does not go beyond 80 degrees 20 minutes of north declination. The well-known need of additional work—especially fundamental work—in this part of the heavens has led me to outline a plan for fundamental observations of the circumpolar stars, which has not, as far as I know, been hitherto suggested or put into practice.

One of the chief difficulties in making fundamental determinations of the right ascensions of the stars at low declinations is in securing sufficiently accurate time keeping. This difficulty almost disappears near the pole, where an error in time means a much smaller error in space. The possibility of making observations at both upper and lower culminations is an important advantage in circumpolar work in both right ascension and declination. Those circumpolar stars which are bright enough to be seen in the daytime with meridian instruments are frequently observed by astronomers at both culminations at all times of the year. During the fall and winter months when in middle latitudes there are from twelve to fifteen hours of darkness daily, it is practicable to observe the fainter circumpolar stars at both upper and lower culminations. For six months of the year it is possible to work for an hour or two in the evening, between five and seven o'clock, observing a certain list of circumpolar stars as they come on the meridian at either upper or lower culmination. In the morning, twelve hours later, the same stars may be observed, each at the other culmination. In this way it is possible to observe with one instrument in a single year, at both upper and lower culmination, nearly all stars down to the seventh magnitude within ten degrees of the pole.

With a meridian circle provided with the usual accessories, including suitable meridian marks, the work may be made practically fundamental in both right ascension and declination. The right ascensions of ephemeris stars near the equator, used as clock stars, are known with sufficient accuracy so that the effect of their systematic errors may be neglected without serious error in observations of stars within 10 degrees of the pole.

Each pair of observations of the same star at both upper and lower culminations on the same day gives a fundamental determination of the azimuth of the meridian mark and the latitude of the place of observation, the observations in declination being made from the nadir. The observations of each night should be reduced with the azimuth of the mark and the latitude as found from the observations of that night, as in this way the effect of the recently discovered slight motion of the zenith-point is eliminated from the observed places. The more troublesome errors of personal equation will be eliminated from the final results of a year's work. In declination, the effect of errors of flexure of the instrument and of the refraction tables will be small. They will be somewhat smaller perhaps the higher the latitude of the place. Accidental errors of observation will be reduced to a minimum since the atmospheric conditions are usually best in the early morning and evening, and will be smaller at the higher latitudes. Observations made in this way will give the variation of the latitude as well as its mean value, and also the variation of the azimuth of the meridian mark. By observing, in addition to the circumpolar stars, stars which are selected for the purpose, corrections may be found to the refraction tables and to the constant of aberration.

The clock should be a good one, but need not be of unusual excellence. The instrument should be of the best quality, and its errors in both right ascension and declination should be investigated as completely and as rigorously as possible. The work should be done in both positions of the clamp of the instrument, and with the object glass and eye-end interchanged. All instrumental constants should be determined when the observations are made. In short all expedients should be resorted to to eliminate accidental and systematic errors —especially the latter—as it is only in this way that fundamental work can be made of value as such in the present state of astronomy.

The observations may be corrected for clock and instrumental error by either Mayer's or Bessel's formula. If the latter, which is perhaps the more convenient of the two, is used it may be put in the form,

$$a = T + \Delta T + m + (n + c) \tan \delta + c (\sec \delta - \tan \delta)$$

in which the quantity n is computed from values of the level constant found with the spirit level and a from observations on the meridian mark. The term c ($\sec \delta - \tan \delta$) may be used in the forms $c/(\sec \delta + \tan \delta)$ if more convenient. As is the case with all astronomical work, the value of the results will depend on the perfection and power of the instrumental outfit, and the skill with which the various processes are carried out. This plan of observation is of course applicable to the southern as well as to the northern circumpolar stars.

It may not be out of place to speak in this connection of the need of an extended series of fundamental observations of the brighter stars at all declinations, to supplement the work being done at Greenwich and Pulkowa. Astronomers who are interested in this subject feel the desirability of such an addition to the material at present available, from which to construct a general catalogue of several thousand stars whose places are based on an absolute system. The stars should be selected with reference to distribution, magnitude, color and other characteristics which affect their suitability to serve as standard points of reference. Such a catalogue is needed for a variety of purposes, among which may be mentioned:

1. As a basis for determining the positions of the fainter stars, by differential meridian circle observations or by photography.

2. For more convenient and accurate determination of longitude and latitude in geodetic work.

3. To make possible a more accurate and extensive determination of the proper motions of the stars in all parts of the heavens, which together with spectroscopic measurements of motions in the line of sight, likely to be greatly increased in the near future, will increase our knowledge of the proper motion of the solar system and also the motions and distribution of the stars in space.

4. To serve as a universal standard to which the great mass of existing star-catalogues, systems of star-places and series of observations may be reduced by the application of systematic corrections, thus harmonizing and making available for use a large amount of nonhomogeneous material.

There is perhaps no observatory in the world better located geographically for carrying out a series of observations of this kind than the Naval Observatory at Washington. While not an ideal climate for astronomical work in general, the climate of Washington is very good for work of this kind. The ground on which the observatory is situated was chosen with special reference to its suitability for the stable support of instruments and also with regard to freedom from unfavorable local conditions. As regards its latitude, 38 de-

grees 55 minutes, Washington is admirably situated for making observations intended to supplement the work of the European observatories and at the same time that of the observatories of the southern hemisphere. It is twelve and one half degrees south of Greenwich, twenty degrees south of Pulkowa and seven and one half degrees south of the new branch of the Pulkowa Observatory at Odessa. Stars of thirty degrees south declination are observed on the meridian at Washington at an altitude of twenty-one degrees and very near the zenith at Cordoba and the Cape of Good Hope. Being ten to fifteen degrees south of the observatories of central Europe, and yet far enough north for accurate observation of the circumpolar stars, perhaps no location better in this respect could be found for extending the accurate star places of the northern hemisphere thirty degrees or more south of the equator for comparison with the results of observations made in the southern hemisphere.

The value of the great work on the positions of the stars which has been carried on at Greenwich during the two hundred years which have elapsed since Flamsteed's time is recognized by every astronomer. As an example of continuous activity directed toward a definite end it is perhaps without a parallel in the history of science. Until 1850 a transit instrument of five inches aperture and a mural circle six feet in diameter, both by Troughton, were used. In that year the present Greenwich transit circle of eight inches aperture and twelve feet focal length was mounted by Airy. The axis is six feet long and the divided circle is six feet in diameter. While one of the most powerful instruments of its kind in the world, its construction is such as to make it liable to systematic error. No meridian mark is provided, although the north collimator was at one time used as such, and the spirit level is not used. Furthermore, the instrument cannot be reversed.

The great value of the fundamental work which the Pulkowa Observatory has done during the past sixty years is generally recognized. The instruments used have been of the best quality and their construction has been improved from time to time. The methods of observation are of the highest class and the systematic errors of the results have been found to be very small. But at the extreme north latitude of Pulkowa, the altitude of the sun on the meridian at the winter solstice is only seven degrees, and stars at the celestial equator are observed at an altitude of only thirty degrees. As a consequence the best work of that observatory is limited to stars of north declination. With the good judgment and enterprise which have from the first characterized the management of the Pulkowa Observatory, the branch observatory, mentioned above, was established in 1898 at Odessa, thirteen degrees further south, where valuable work is no doubt being done.

But all instruments and all methods of observing have their peculiar forms of error, and it seems clear that the establishment of a third center in the northern hemisphere for continuous fundamental observations of the stars is very desirable.

Milton Updegraff.

U. S. Naval Observatory,
Washington, D. C.,
June 15, 1902.

THE CARNEGIE INSTITUTION.

The provision for research constitutes a supremely important part of the intellectual organization of a great nation. A profound recognition of this fact has brought into existence the Carnegie Institution. I have elsewhere recorded (*The Dial*, February 16, 1902) my appreciation of the general aims and purposes of this

notable foundation. The immediate problem, to which the editor of SCIENCE invites attention, is the inauguration of measures that shall most effectively aid the cause of original investigation; that shall relieve such obstacles as now beset the free development of the spirit of research in our midst; that shall encourage and promote the realm of scientific discovery, and give to research as a profession the dignity, appreciation and outward marks of success to which, as a potent contributor to vital interests of our civilization, it is unquestionably entitled.

It would be unwise for everyone whose concern in this problem is deep enough to induce him to give expression to it, to suggest ways and means of spending the income of ten millions of dollars. From what I have been permitted to learn of the intentions of the Carnegie authorities, I have inferred that they would regard as helpful, first, concrete suggestions as to the kind of expenditure which would do most for the cause of research, and the principles of inclusion and exclusion that shall be operative in determining the field of practical endeavor which the institution shall make its own; and, second, the suggestion of special researches for which funds are needed—which this or that individual is ready to undertake, and which an appropriate committee would be willing to endorse. The second portion of this program presents little that is novel; provisions for such endowment of research already exist, though to a very inadequate extent, and the Carnegie Institution will be able to offer more of such assistance and to maintain a directive oversight of such research in a far more comprehensive way than has been possible hitherto. The first part of the problem is at once more fundamental and more difficult; it requires a broad consideration of the actual conditions of research, of the relations of the Carnegie Institution to the universities, to the governmental bureaus, to academies, to scientific associations, etc., as well as a consideration of the kind of encouragement which research requires, the deficiencies in the organization of research that demand correction, the direction in which future progress is to be shaped. It is to a few aspects of this problem that I shall address myself.

The direction in which, in my opinion, greatest utility lies is in the endowment of men rather than of projects. Hitherto in grants for research in America the emphasis has been decidedly in the opposite direction. There are, indeed, some grants to which a condition is attached that no part of the fund shall be used for personal expenses, nor for anything but apparatus and materials. The expert service involved, both of the investigator and of such assistance as he might require, must be freely offered. As a consequence, only those who have private means or who hold other positions yielding them alike sufficient income for a living and the requisite leisure for investigation, have been able to avail themselves of such aid. There will always be a number of persons of this class ready to engage in most desirable and important investigation, to whom substantial encouragement should be given; this is good as far as it goes, but it does not go far enough. If this were to be the sole or the chief function of the foundation, there would be a Carnegie Fund, but not a Carnegie Institution. There are many investigations that require not so much costly apparatus as extensive cooperation; the service of computers; clerical aid; opportunity for conference between leaders in related investigations; opportunities for travel and collection of material; and beyond all, leisure, release from instructional duties or other occupation necessary for gaining a livelihood. While research is an

avocation with many, it is a vocation with few; and the many pursue their investigations amid needlessly unfavorable conditions.

If this description of the status of affairs is approximately correct, the remedy would seem to lie in the direct endowment of men. If we have men who are precisely fitted by training, bent, devotion and ability for the work of research, why not provide the means for their support and leave them financially free, at all events, to devote their energies in the direction in which they promise greatest success? Undoubtedly they will require materials and apparatus—in some cases a most expensive equipment—but in nearly all cases they will first and foremost require a secure living and leisure. The elevation of the career of the devotee to research to a worthy professional standing would seem to be the special function which the Carnegie Institution can serve in behalf of learning in America.

In pursuance of such a policy there would be at once recognized the danger of interfering with the growth of the provisions for research now established or likely to be established at the universities. Such a possibility must be carefully guarded against. If it were to become the vogue for the university authorities, when the question of provision for research came up for discussion, to transfer such responsibility to the Carnegie Institution, quite as much harm as good would be done. The various ways in which the spirit of research is not only helpful but vital to the flourishing of true university work have been repeatedly and ably set forth; it will continue to require zealous protection until it becomes firmly established as an integral factor of our educational system. As a means of fostering the cause of research without needlessly releasing the universities from their true responsibilities, the suggestion is near at hand that the Carnegie funds shall, here and there, be used to pay a portion of the salary or supplement the salary of this professor or that, on condition that he be relieved from all but a minimum of teaching, and thus be able to devote much of his energies to special research. An arrangement effecting substantially the same result exists in the case of geologists who hold an academic and a governmental position, and are able to minimize the instructional obligations of the former, while utilizing to the full the research facilities of the latter position. The university funds thus released would naturally be used for the engagement of an assistant, upon whom would fall the instructional and other work so frequently the serious obstacles to successful investigation. I do not advocate, except in special cases, the complete separation of instruction and investigation; on the contrary, I am convinced that each is helpful to the other, and that even the synoptic survey of one's science which an introductory course makes necessary is a useful task for the professor occasionally to assume, while the opportunity to serve as a leader to able young men is both stimulating and profitable. It is only to the extent that instructional and administrative routine interfere with the scholar's advancement along the lines of his special fitness, that provision should be made to prevent the sacrifice of the latter for the former.

In this connection a reference seems permissible to the special conditions under which the professor (for we may assume that in this country the typical man of research is a professor) must live and work. He is not independent; he is not free to follow his own inclinations; he has prescribed and absorbing duties. As with most men his income conditions his activity. He must first do that which is necessary to gain a living for himself and family, and to occupy that place in society which his

position makes proper. To accomplish this, an undue amount of care and effort is now expended; many a professor would have pursued a career of research had the necessity not been presented to him of increasing his income, owing to the insufficiency of his salary. With a larger salary, he would have felt free to engage such clerical assistance as was needed to release his own time, he would have refused offers of publishers to write text-books, of editors to prepare articles, would have provided himself liberally with books and the tools of his trade, and lived a life of greater approximation to his ideals than proved to be possible. Considered merely from a practical point of view, I have no doubt that the employment of a secretary in one case, of a laboratory assistant in another, of an increase in salary for household expenses in a third case, would really prove to be the most efficient, though indirect, aid to research. For when reduced to the lowest terms, the factors of which successful research is a function are these: the capacity for it, the material equipment, the time and energy. Assuming the first, and recognizing the various efforts which our educational institutions are putting forth to develop it, we have acknowledged the decided aid that comes from the provision of the second, and yet place the greater emphasis upon those measures which, with discernment and adaptation to actual conditions, make possible the enthusiastic devotion of time and energy to the field of research. As a fourth factor should be added the honors and attractions of the investigator's career, and the consequent inducement for the ablest young men to follow such a career. That the Carnegie Institution has the possibility of doing much in this last direction I have already maintained.

In other words, it is my conviction that the most serious obstacle to the proper development of original research in America lies in the circumstance that those with greatest capacity for it do not make strenuous efforts to secure the material equipment they require (in so far as they do require it), because of the fundamental difficulty that the time and energy they have to give to the work are inadequate. The primary remedial measure must accordingly be the readjustment of their personal status, which shall make it unnecessary for them for the sake of income to devote their energies to other pursuits. In so far as such other pursuits are directly helpful to the intellectual career of the investigator, they should unquestionably be maintained; in so far as they contribute little or nothing to his investigating efficiency, they should be transferred to others, who, though occupying an equally important position in the educational world, find their greatest sphere of usefulness in another field. There is no implied disparagement of the professor's career as a teacher; that phase of his activity is for the present not under discussion. We are discussing the career of the investigator, and believe that the university furnishes an admirably suitable atmosphere for his development; and that it is very fortunate for the university to have among its members a considerable group who are primarily investigators. One of the principles of modern organization by which the services of individuals of decided ability are distributed as comprehensively as possible is that the director shall not do that which any of his assistants can do as well. This is the true economy of time and energy. My plea is for the more adequate extension of the same principle to the academic life; it is on account of the lack of proper assistants, and of a lack of a proper income to employ them, that the energies of some of our ablest men in the higher educational institutions are not utilized to the best ad-

vantage, are, indeed, in extreme instances, shamefully wasted.

Having ventured so far in the presentation of this point of view, I shall venture farther to defend it against one form of objection to which, in the opinion of some, it seems to lie open. We are told that a fellowship may degenerate into a form of almsgiving, that men need not be paid to study or to investigate, that grants to individuals smack of paternalism, and so on. To my thinking these positions are entirely false; and when a college president maintains that 'great gifts to education have been for the purpose not of feeding men but of furnishing means of study and investigation beyond the reach of individual effort,' he expresses a strangely perverse view of the situation. If we can only feed the right man—to hold for the moment to this needlessly brusque form of statement—we cannot perform a more notable service than by thus supplying at least one of the conditions for a career of greatest potential value to the nation. In one sense the greater portion of all educational endowments goes towards the maintenance of men. Fortunate, indeed, is the state of affairs that in some cases makes such endowment unnecessary. In reading the history of science in England one is repeatedly thankful that this man and that were so situated financially that they could devote their whole time and energy towards contributing to the world's knowledge. As we read the life of Huxley we share with him the feeling of relief when a comfortable living was at length assured him. It will hardly do to say that the true investigator will come to the front and create the conditions needed for his work despite all personal hardships and deprivations. The question is always painfully apropos: Where are the ships of those who were not saved and whose gratitude is not recorded by the models suspended from the church beams? The cases of successful achievement despite inadequate facilities and encouragement should never be forgotten; but the great unknown mass of possibilities that lie buried beneath the waves of adversity likewise tell to the imaginative a suggestive story.

From the initial encouragement of a fellowship up to the highest honors of the scientist's career there should be rewards and appreciations, equal at least to those that invite men of exceptional talent in comparable spheres of intellectual activity. When the editor of SCIENCE tells us that 'the greatest obstacle to the advancement of science is, in my opinion, the circumstance that scientific men are not directly rewarded for their investigations and discoveries,' he is not implying any special lack of altruistic sentiment on the part of men of science; he is forcibly pointing out the essential disparity between the attraction to men of rare powers of the scientific and of comparable careers.

I have not left myself space to speak of other practical suggestions deducible in conformity with my main thesis. This is, perhaps, the less necessary, as the editor of SCIENCE has already indicated some of them. The establishment of at least a few notable prizes and of supplementary and adequate salaries for the encouragement of research are more ambitious but equally logical deductions from the principle of the direct endowment of men. The establishment of research fellowships is another. The creation of a board of managers for the institution, membership in which shall constitute a great honor and be suitably rewarded, is again in conformity with this view. It would be a great aid to the status of the university professor if there were some great prizes in the educational world outside of the administrative field. As it is, the college presidencies offer the most attractive incomes to men seeking the edu-

cational career. This is doubly unfortunate, as it has served to overvalue the particular grade of ability which such work demands, and to undervalue the intrinsically superior capacity needed for eminent success in the field of investigation.

I have likewise omitted direct reference to the question of a distinctive Carnegie Institution at Washington. I have made it clear that such an institution is indispensable to the realization of the larger national place for research which I have advocated. It is because I feel that the immediate danger is that the Carnegie Institution may become a great subsidiary agency and nothing more, that I have selected the opposition to that plan for my major thesis.

To bring my plea to a focus, let me attempt to repeat briefly the points of emphasis:

1. That the Carnegie funds shall be devoted primarily to the endowment of men; without neglect of the fact that many projects demanding cooperative* energy and special equipment are worthy of encouragement.

2. That the Carnegie Institution shall distinctly supplement and in no way diminish or discourage or absorb the existing provisions for research.

3. That the path of endeavor and plans for the inauguration of progressive measures be determined by an inquiry in regard to the obstacles and difficulties that now beset the career of the investigator and be directed to the removal of those difficulties.

4. That the Carnegie Institution adopt as one of its peculiar missions the establishment both of general conditions and of special attractive rewards for the successful investigator and the encouragement of the man of promise, and in this and other ways place the career of the professional investigator upon a more secure and more honored footing than it now occupies.

JOSEPH JASTROW.

* I have omitted for lack of space any concrete illustrations of the cooperative or centralizing functions which the Carnegie Institution might serve. A good instance would be found in the establishment of a central instrument works. Most professorial inventors carry their inventions up to the just-workable and barely-presentable stage. If at this point the apparatus could be sent to a central bureau where it would be technically perfected by mechanical specialists, reproduced and supplied to laboratories at cost of production, a very great boon would be offered to the devotees of almost all the sciences.

TO THE EDITOR OF SCIENCE: Referring to your interesting article on the Carnegie Institution, and responding to your request for suggestions as to how the fund might be utilized, I would respectfully submit that a portion of the income might well be made available to enable members of the faculties of the smaller, but poorly endowed, colleges to enjoy the advantages of a sabbatical year. Smaller colleges cannot, as a rule, afford to give their faculties this much-needed change, and the men cannot afford to spend the year without salary. In fact, they can hardly afford to take even a vacation trip to the great educational centers.

An arrangement might be feasible whereby a college would guarantee, say, one fourth of a man's salary, and the Carnegie Institution might guarantee one half, or better still, three fourths, on the condition that the year be spent in actual work at one of the well-equipped universities or in one of the government laboratories. If the man went abroad the condition should be made that his time should be spent in a country the language of which he understands.

By this plan, not only would many an underpaid and overworked college teacher, now isolated from proper library facilities and from contact with men in his own line

of study, be able to 'work up' interesting and valuable material collected during his isolation, but he would enjoy a much-needed and revivifying change of scene and association, and the advantages gained by him would be of direct value to his college, to his students, and to the general education of the country. At the same time, he could count upon fourteen months for research.

Should such a plan meet with approval, it would perhaps not be unreasonable to ask the prominent and more wealthy universities to establish free Carnegie fellowships, thus relieving the men in question from the payment of tuition, laboratory fees, etc.

Ch. Wardell Stiles.
U. S. Public Health and Marine-Hospital Service.

There are two points not yet brought out in the discussion: (1) The stamp of approval of the Carnegie Institution is likely to act as a patent of nobility and to make certain lines of research creditable, that is, acceptable to authorities who are influenced, not infrequently, by what 'is made in Germany.' (2) The most 'conspicuous waste' to-day is that of the man who *might be* the 'exceptional man' if he and his parents before him had lived up to the possibilities of perfect manhood which scientific knowledge now offers to those who value it enough to work as steadily to attain it as the business man does to gain the power to build a palace.

It is not enough to attain to great administrative ability, control over other men. The exceptional man now in demand is the one most ethically efficient as a man among men, as an exponent of what the human race is capable.

That is the kind of man it is the noblest privilege of mankind to study: that is the new humanities.

Two years of time in the secondary school and one year of time in college might be saved to at least one third the students in the country if they understood human œkology—the science of right living.

Dr. Sternberg's closing paragraph indicates one of the directions in which help must come, but there is needed a philosophical basis for the improvement of the race before the work will proceed far.

E. H. Richards.
Laboratory of Sanitary Chemistry,
Mass. Institute of Technology.

In response to an invitation from the editor of Science to express my views on the question how can the Carnegie Institution best advance science, I would repeat substantially the terms of the deed of trust: By sustaining original research, by upholding exceptional men, by increasing facilities for higher education, by cooperating with existing institutions, by promoting prompt publication; and *by doing all these things on a business basis.*

Though not expressed in the deed of trust, the last clause is sufficiently implied by the character of the donor, and it states a consideration which must control any action of the trustees. It is here emphasized because it serves to explain, to the writer at least, some of the differences of opinion which have recently been published.

To conduct research on a business basis is difficult, and, if the experience of the U. S. Geological Survey be a safe guide, requires the application of certain principles, which, though commonly recognized, have not always been applied in professional work. The first: Authority and responsibility are inseparable, is so familiar and fundamental as scarcely to need statement; but in practice it often requires subordination of one individual to another in a manner antagonistic to scientific inde-

pendence, and just consideration of the right to opinion leads to the conclusion that authority should be restricted to the domain of business and should not intrude in the realm of knowledge.

From this follows a distinction which may be stated as the second principle of an organization for research: Administrative control should be separate from scientific direction. The former then allots funds, supervises accounts, provides assistants and facilities, refers questions, gets out accepted results; in a phrase, its function is to run the machinery efficiently. Its control over and responsibility for moneys should be absolute. On the other hand, scientific direction consists in planning and approving plans, suggesting investigators, aiding them through broader knowledge, considering results and approving them for publication. Its control and responsibility are both partial and also widely variable, according to the relations existing between the director and the directed. In the Carnegie Institution this second principle appears to be recognized in the relation of an executive board and of a president who executes the purposes of that board to the several advisory committees composed of specialists in different branches of science.

In an organization thus built up of workers, advisers and administrators, cooperation becomes a vital principle to be not only accepted but cordially adopted and practiced. By cooperation in these relations I mean entering into one another's views and plans with an intelligent, sympathetic, though judicial understanding, with the one object of advancing the purpose of the organization. We may confidently hope that the Carnegie trustees and the scientists who are or may be associated with them will act with such breadth and liberality of opinion that cooperation will not fail.

Again, from the business point of view, the trustees bear a heavy responsibility for the administration of the trust fund, and must necessarily view any proposition from a side other than that from which a scientist may regard it. In weighing the relative merits of the many demands which are being and will be made upon them, the members of the executive board must have ever in mind the purpose to promote science as distinguished from the opportunity to aid individuals or institutions. To the specialist who is ideally a man of single purpose their conclusion may not always seem obviously just, but it will be a safe basis of action. The case of the exceptional man who may be most liberally supported does not conflict with the general rule, since if he be the exceptional man—a Huxley, for example—his advancement is the advancement of knowledge.

I am indebted to the editor for opportunity to read in proof his own contribution to the discussion of the Carnegie Institution, but he covers much ground with which I am too little familiar to tread securely, and I regret that in those items where my opinion is based on experience in organization, I must differ from him. The Marine Biological Laboratory at Woods Holl, known for the high standard of its work, has a claim upon the interest even of those who, like myself, had no personal knowledge of its management, but the statement which admits the handicap of financial difficulties as a result of democratic organization is an indictment of that organization, and the fact that the members possessed high qualities of enthusiasm, devotion and capacity for self-sacrifice does not relieve the organized body of responsibility for inefficient administration if such there was; nor does that fact relieve the trustees of the Carnegie Institution of responsibility as trustees for the most efficient use of any fund they might allot to the work of the Laboratory. The as-

sumption that large expenditures for administration must follow from their management appears gratuitous, and the charge that they may crush out the public spirit of the Laboratory is not warranted by any facts made public.

A geophysical laboratory, as an object of investment on the part of the Carnegie Institution, does not commend itself to the judgment of the editor, but a laboratory for psychology does. Will I be understood if I plead inability to render an unbiased opinion in a case where my interests as a geologist are so nearly concerned?

The establishment of a board of managers consisting of twenty eminent scientists, as suggested by the Editor of SCIENCE, is a feature of a plan which perhaps should be discussed as a whole if at all; but with regard to such a board it may be suggested that it will in time develop, if it is needed, from the cooperative relations of the special scientific committees. And until the obvious need leads to evolution of additional organs, those which the Carnegie Institution now has may well be allowed to demonstrate their fitness to accomplish the ends of its generous founder.

BAILEY WILLIS.

LAMPASAS, TEXAS,
September 23, 1902.

SCIENTIFIC BOOKS.

Bibliography and Catalogue of the Fossil Vertebrata of North America. (To the end of the year 1900.) By OLIVER PERRY HAY. Bull. U. S. Geol. Surv., No. 179, pp. 868, 1902.

The present volume represents several years' diligent work on the part of a writer who has faced the hapless task of unraveling the literature of American fossil vertebrates. Of course such a task is by no means that of such a Hercules as C. Davies Sherborn, who is indexing no less than *all species of animals;* but I fancy it has been found tedious enough. It is missionary work certainly, and its author deserves the gratitude of paleontologists, who would otherwise have had to have searched through 667 references for a species of Cope's, 225 for one of Marsh's, 221 for one of Leidy's. And the reviewer speaks feelingly, for he has occupied himself *en amateur* in a far smaller bibliographical study during the past half-dozen years, and can picture better than a layman the roomful of closely written cards which the author must have accumulated, and the mere physical labor of hunting up, handling and thumbing a mass of books which if put on a single shelf would extend over a mile. Dr. Hay has not merely ransacked libraries to complete the bibliographical writings of all authors who have meddled with American fossil vertebrates, but he has aimed to introduce a complete list of the anatomical and embryological references which bore upon the theme in hand. Then he has picked out the species and fitted them together in systematic arrangement, and finally made the names accessible by means of an elaborate index.

Before criticizing such a work as this, one must evidently bear in mind that absolute accuracy or completeness cannot be hoped for. Oversights, omissions and even proof errors are inevitable, and a fair critic, appreciating the volume's general tone of painstaking accuracy, cannot but feel that it deserves good wishes and scant blame. Its bad mistakes are rare, but minor omissions, points of disagreement and small errors are not uncommon. Its greatest defect is in the matter of cross-references to paleontology which occur in embryological and anatomical papers,—a defect which, however, would be naturally expected in a work of this kind. Its bibliographical lists, on the other hand, are generally accurate and well chosen, and are so complete indeed that one regrets that they are not perfect. Running over the names with which I am most familiar I find, for example, such omissions as these: *A. A. Wright,* a '97 Dinichthys paper; *Keyes,* Geology of Polk County ('97 Report of Iowa Geol. Survey); *Emerson,* Geology of Old Homestead County, Mass.; *Vaughan,* Geology of N. W. Louisiana; *Redlich,* on Ptychodus; *Seely,* on *Ceratodus; Dollo,* on *Lepidosteus; Leydig,* on Koprolithen u.

Urolithen; *Scupin,* important reference to Rhynchodont dentition; *Manigault,* on the source of the S. C. phosphate deposits; and a number of omitted references in the case of such authors as *Priem, Rohon, Sauvage* (of this author no titles given after '88), *Traquair* and *Smith Woodward.* And so on through the book, doubtless, if a critic chooses to use a microscope. I note, by the way, no reference at all to the Devonian 'lamprey' *Palæospondylus,* upon which much has been written during the past decade. Probably this omission is due to the absence of this vertebrate in American localities, a reason which would be valid, even in the case of so interesting a form, had the author not repeatedly violated his rule and given prominent reference to such exotics as *Archæopteryx, Pareiosaurus* and monotremes. Also there is no reference to conodonts, which are surely American enough, but omitted, doubtless, on account of their questionable kinship to vertebrates. Certainly they at least deserve mention, since *some* of them, as Hinde has shown, are strikingly similar in structure to the dental cusps of hagfishes.

Dr. Hay has of course made a number of name changes on the score of priority, a result which was to be expected and dreaded in such a work, for it is a sad trial to have a long-known friendly name whisked away and a strange one, archaic, often intrinsically objectionable, substituted. Sometimes, though, we have to be grateful for an accustomed name even in bad Greek or misspelled, and the purists' use of *Lepisosteus* and *Crocodylus* is the smaller thorn in our flesh. I think, however, that Dr. Hay has overdone the matter in certain cases, for my feeling is that the community at large will resist any name-change where there is the slightest chance of mistaken identity, or where an older group-name is made useful only by torturing its definition into shapes which its author never dreamed of. As a pertinent example of a change of the former kind take the use of *Acanthoëssus* for the well-known paleozoic shark *Acanthodes.* Both are names given by Louis Agassiz, who, having received better material, rejected *Acanthoëssus,* which *may* have been based upon congeneric specimens: but as Agassiz, who was in a position to decide the matter, does not assure us that the forms *were* the same, I can see no adequate reason for resurrecting the earlier name, especially since the types of *Acanthoëssus* are lost! As an example of a change of the latter class observe the dilatation of Cope's order of sharks, Ichthyotomi, so as to include the cladodont sharks of Ohio (Pleuropterygii). Now as a matter of fact this term, even in its restricted sense, can be used only by twisting the definition heroically, for, as many know, it was based upon some Permian shark heads in which Cope mistook artifacts for separate bones, and his definition of Ichthyotomi has in consequence been found to be erroneous on every count; but as it happened that the sharks in question were Pleuracanths, well known in the Permian of Europe, there gradually filtered into the collapsed definition the facts of Pleuracanth vertebral column and fins —but no facts or modifications which could warrant placing within this group the cladoselachian sharks when later these became structurally known. In this connection I may note that Claypole's Ohio '*Cladodus*' is the same as *Cladoselache,* for although Claypole did not give reasons for his position, he failed to acknowledge the validity of the newer genus. So it comes about that Dr. Hay has one half of the Pleuropterygians arranged under one order and the other half under another. A second instance of the use of a term insufficiently defined to be of legitimate value is the resurrected Aspidoganoidei of Gill. On the other hand, in creating a new group-term, Aristoselachii, it seems to me that Dr. Hay does not practice what he preaches in this very matter of priority. For this term includes precisely the forms for which *Selacha* was used by Bonaparte about 1840. Another inconsistency is in his use of *Pisces* for fishes *not including* sharks, rays and chimæroids: for this rather startling use of the term he cites as authority the X. éd. of Linné, but I fancy that priority itself does not require us to hold fast to this misconcept of Linné for since the time of Aristotle or even Ray and Artedi, the term *Pisces* has just about the same meaning in which it is accepted to-day.

But the especial inconsistency is this: if Dr. Hay wishes to use Linné's *Pisces* so as to exclude the sharks, why has he the right to put back into this term of Linné such forms as sturgeons, anglers, sea-porcupines, pipefishes and the like, which Linné himself cast out with the sharks? If this can be done, evidently the sharks also can be restored, and *Pisces* reacquires its normal use.

The present volume touches upon a number of points in which judgments may differ—when one author treads perilously near another's vagaries. Thus I note that Dr. Hay has no scruples in associating such obscure forms as Coccosteans and Pteraspids with true fishes (while ejecting sharks!). Also that the Arthrodiran Placoderms are still grouped with the lung-fishes, as also for the first time are Pterichthyids—and for the latter annexation no reasons are given. These forms are altogether grouped as Azygostei, a new subclass, equivalent to Teleostomi, based doubtless on the presence of a median row of cranial bones; in this event it is evidently a *nomen delendum,* for a similar row of bones occurs admirably in Teleostomes, *Acipenser,* for example. Within the latter subclass the use of Rhipidistia, p. 357, as a superorder equivalent to Crossopterygii, is evidently an oversight.

On all scores, though, returning to our original text, Dr. Hay's volume is a mine of gold to the paleontologist, and the officials of the Geological Survey are to be congratulated on having secured it and given it publication. Such works cannot be too plentiful or too welcome. In another case, however, the publishing authorities would add a helpful favor to specialists if they gave the book a wider margin—say, of two inches at the bottom of the page—so as to facilitate the insertion of addenda and corrigenda.

Bashford Dean.

Neurological Technique. By Irving Hardesty, Ph.D. University of Chicago Press, 1902. Pp. 185; 4 figures.

Professor Henry H. Donaldson, in his short introduction to this little volume, states that its object is to serve as an introduction and laboratory guide to the study of the architecture of the nervous system. The material considered falls into three divisions: (1) Laboratory methods; (2) an outline for the examination of the central nervous system; (3) a classified list of the neurological nomenclature (B N A) accepted by the German Anatomical Society.

Excellent judgment has been shown in the selection of the laboratory methods, and care has been exercised to bring to the notice of the student only such methods as may be employed with some assurance of obtaining satisfactory results. In case a number of methods are at hand, which bring out, differentially stained, certain elementary constituents of the central nervous system, only the most important are considered or several methods are combined into one workable method, thus avoiding confusion and, at the same time, enabling a student to employ his time most economically. The methods selected are given in full. The descriptive account of each method is prefaced by a statement in which are enumerated the reagents which will be required in each step of the method and in the descriptive account each reagent used and the time during which it should act are printed in heavy type. The student may thus at a glance ascertain the steps of a method. This portion of the volume, while compiled primarily for the beginner, will prove of service to the investigator and teacher as presenting in compact form the essentials of neurological technique.

In the outline for the dissection of the central nervous system, the (B N A) nomenclature is used almost exclusively. This outline is based on the human central nervous system and consideration is given only to the macroscopic anatomy of the organ; with the exception of certain external features, it may, however, be used for the study of the nervous system of the larger mammals. The outline presupposes that the brain and cord used have been fixed in formalin, and that only one specimen is at the disposal of the student. Attention is drawn to the external features of each region, after which the student is directed to make sections along certain planes located by surface markings, each section thus obtained being considered seriatim. A number of fig-

ures are added to facilitate the location of the section planes.

Timely emphasis is given to the (B N A) nomenclature, and it is hoped that this may hasten its wider adoption. The volume as a whole should prove useful to the student and will no doubt aid teachers in formulating courses in neurology. The typography and press-work are to be commended.

G. Carl Huber.

SCIENTIFIC JOURNALS AND ARTICLES.

Journal of Physical Chemistry. May. 'Synthetic Analysis in Ternary Systems,' by A. W. Browne. This is the description of several experimental applications of Bancroft's new method for analyzing the solid phase appearing in three component systems without removing it from the mother liquor. 'On Indifferent Points,' by Paul Saurel. 'Studies in Vapor Composition, II.,' by H. R. Carveth. A study of simple experimental methods discovered by the application of the phase rule. 'Note on the Optical Rotatory Power of Cane-sugar when Dissolved in Amines,' by Guy Maurice Wilcox. In such solutions sugar is found to have a much higher specific rotatory power than in water.

June. 'The Rate of the Reaction between Arsenious Acid and Iodin in Acid Solutions; the Rate of the Reverse Reaction; and the Equilibrium between Them,' by J. R. Roebuck. An experimental study of the law of the rates at which chemical reactions take place in homogeneous systems. 'On the Triple Point,' by Paul Saurel. 'On the Theorem of Tammann,' by Paul Saurel. 'Experiments on the Electrolytic Reduction of Potassium Chlorate,' by G. H. Burrows.

The Journal of Comparative Neurology for September contains a memoir of 85 pages and two plates by Professor G. E. Coghill, of Pacific University, entitled 'The Cranial Nerves of *Amblystoma tigrinum*,' in which the components of the cranial and first two spinal nerves are described in detail and plotted after microscopic reconstruction. This is followed by an exhaustive comparative discussion of these nerves in the light of other Urodela.

SOCIETIES AND ACADEMIES.

RESEARCH CLUB OF THE UNIVERSITY OF MICHIGAN.

The first meeting of the club was held on the evening of October 8. Mr. Alfred H. White gave the first paper, speaking on the 'Theory of the Incandescent Mantle.'

Data were presented of temperature measurements made upon two kinds of mantles. A pure thoria mantle attained a temperature of 1510° C. and its illuminating value was 1.2 candle power. A mantle with one half per cent. ceria showed a temperature more than one hundred degrees lower and gave thirteen times the light. The conclusion was drawn that the illumination of a mantle was to a greater extent dependent upon the composition of the mantle than upon the temperature. This opposes the conclusions of Le Chatelier and Nernst, who hold that the thoria-ceria mantle attains a higher temperature than a mantle of any other material, and that this causes the unusual illumination. The theory was advanced that the substance of the mantle was a solid solution of ceria in thoria which was capable of transforming the heat of the flame into light more economically than any other substance yet known.

Professor F. Haber, of the Carlsruhe Polytechnicum, who was present as a guest, said that investigations as yet unpublished, conducted by his colleagues Bunte and Eitner, had established the same fact, that a mantle of pure thoria attained a higher temperature but gave less light than one of the usual thoria-ceria mantles.

The second paper was given by Dr. Huber, and represented work done in his laboratory by himself and Mr. Adamson on the 'Morphology of the Sudoriparous and Allied Glands.'

The observations presented were based on models made after the Born plate reconstruction method. The glands reconstructed included ordinary sudoriparous glands, glands from the circumanal and axillary regions, ceruminous glands and glands of Moll. The tubule constituting the coiled portions of the sudoriparous glands studied varies in length from 4.25 mm. to 10 mm., the excretory duct forming one fourth to about one half of its length. The end of the secretory portion of

the tubule is situated near the duct as it enters the coil. Models from embryonic glands show that the coiled portion of the sudoriparous glands is developed by a folding and knuckling of the tubule, after the first loop is formed. In the circumanal region are found four quite distinct types of sweat glands: (1) Ordinary sudoriparous glands; (2) the large circumanal glands of Gay; (3) branched tubulo-alveolar glands; (4) a modification of type 3. A large axillary gland reconstructed consists of a single tubule measuring 30 mm. in length, much coiled and folded. In this region are also found branched tubulo-alveolar sweat glands. The glands of Moll are tubulo-alveolar glands, with relatively short but large secreting tubules presenting quite regular alternate enlargements and constrictions, from which arise a relatively small number of short tubules ending in large saccular alveoli. The ceruminous glands are similar to the glands of Moll.

FREDERICK C. NEWCOMBE,
Secretary.

DISCUSSION AND CORRESPONDENCE.

A QUESTION OF TERMINOLOGY.

IN his review in *Torreya* of the writer's recent university text-book, Professor L. M. Underwood criticizes severely the use of the termination 'ales' in class names, the special case cited being 'Anthocerotales,' which was used in conformity with the termination 'ales,' employed in the classes of the Pteridophytes, *e. g.*, 'Filicales.' Professor Underwood says: 'The name [Anthocerotes] is changed to *class* Anthocerotales, thus improperly using a termination reserved for a group of ordinal rank alone.'

Without referring to other botanists who have also sinned against Professor Underwood's rule, we should like to ask him to explain certain apparent inconsistencies of his own in this connection.

In the sixth edition (1900) of his little manual of the fern-allies, Professor Underwood uses (p. 65) the same names (Filicales, etc.) to indicate the primary divisions of the Pteridophytes that the writer does in the text-book criticized. Professor Underwood, however, calls these *orders* and not *classes* as they are usually considered to be. Looking for the corresponding class names, we find that Professor Underwood does not, apparently, recognize any classes of Pteridophytes, although he ranks the group as a whole as one of the four subkingdoms of plants. It certainly is not customary among either botanists or zoologists to consider the primary divisions of a subkingdom as of ordinal rank, and it is not quite plain how the employment of the termination 'ales' is sufficient to convert a recognized *class* into an *order*. All of the standard authorities consulted (*e. g.*, Coulter, Sachs, Scott, Warming, Van Tieghem, Vines) agree in calling the Filicales (or Filicinæ) a class; what reason Professor Underwood can give for reducing them to an order is not clear. He can scarcely claim that his 'order' Filicales is of equal rank with the order Marchantiales, for example.

Moreover, Professor Underwood is not as clear as he might be in distinguishing families and orders. Thus, on page 63 we find *order* Equisetaceæ, *order* Calamariaceæ; on page 65, *order* Equisetales; on page 126, *family* Equisetaceæ. A similar confusion is evident in the discussion of the classification of the other subkingdoms (pp. 56–58). Algæ and Fungi are divided into 'classes'; Bryophytes into 'groups'; Pteridophytes into 'orders'!

Perhaps Professor Underwood, as a professed systematist, will explain the principles upon which his classification is based.

DOUGLAS HOUGHTON CAMPBELL.
STANFORD UNIVERSITY.

THE EXPANSION OF A GAS INTO A VACUUM AND THE KINETIC THEORY OF GASES.

IN number 406 of this journal (for October 10) Mr. R. W. Wood calls attention to the fact that the subject of a communication presented by me before the chemical section of the American Association for the Advancement of Science at the last meeting and of which communication an abstract* under the

* The abstract was made without my knowledge and, although it is not bad, there are some loose statements in it. The full article will shortly appear in the *Journal of Physical Chemistry*.

above title appeared in SCIENCE for August 22, had been discussed long ago by L. Natanson in *Wiedemann's Annalen;* and he adds: "This same explanation [referring to mine], only in a much more complete form, was given by Natanson more than thirteen years ago."

I am glad to learn of the very interesting article which treats of the same subject and which was not known to me.

But the treatment and even the object of L. Natanson's article and of my communication are, contrary to Mr. Wood's opinion, widely different. Natanson treats the subject in an elaborate quantitative manner, leaving practically out of consideration the qualitative side of the phenomenon (*i. e.,* the question how it happens that the slow and quick molecules become separated), while I direct my attention only to its qualitative aspect, having attempted to form a simple idea of the mechanism of the phenomenon.

From a statement in his note I see that Mr. Wood misread the abstract; this made it difficult for him to understand its contents.

PETER FIREMAN.

WASHINGTON, D. C.,
October 16, 1902.

SHORTER ARTICLES.

BACTERIUM TRUTTÆ, A NEW SPECIES OF BACTERIUM PATHOGENIC TO TROUT.

THIS organism was obtained from the blood of diseased brook trout and stands in specific causal relation to the disease. The following characterization will be followed by a more extended description.

It is a pleomorphic form which appears in the blood and local lesions of its host as longer or shorter rods, with occasional spherical forms. The rods grow out infrequently into filaments of 6 μ, but average much less, and may be scarcely 0.5 μ in length. The width is 0.5 to 1.0 μ. On nutrient agar-agar it assumes the form of a spherical or subspherical coccus, with occasional rods, the cocci 0.5 to 1.0 μ in diameter. Microscopically the field gives the impression of cocci, but the rods are not infrequent and reach a maximum length of 1.5 μ. In liquid media rods greatly predominate, often arranged in pairs, of a length from that of the diameter of a coccus up to a maximum of 2.35 μ, and 0.48 to 0.83 μ wide. Many of the single rods, when stained, show a slight constriction indicating their separation into cocci, while many give no sign whatever of such a structure. Agar plates made from the blood contain apparently pure cultures of the organism as colonies chiefly of cocci, which become chiefly rods when transferred to bouillon, or when inoculated into trout. In the latter case they reproduce the disease, appear in the blood and lesions as rods recoverable upon agar as cocci. This pleomorphism in different media and the variety of form in the same culture are not reduced by repeated plating.

The organism is non-motile, does not form spores, and a capsule has not been demonstrated. It stains readily by aqueous solutions of the ordinary aniline dyes, and faintly by Gram's method, but its reaction with this stain is not of much value. It grows aerobically on ordinary nutrient media, luxuriantly on agar of a reaction* neutral or +0.5 to phenolphthalein, and will not grow or but very slightly at +1.5; at —0.5 growth is inhibited and at —1.0 to —1.5 scarcely occurs. On agar slants growth is moderately abundant, of a grayish-white color, with age grayish-brown. On usually the third day a production of a soluble pigment becomes evident, which diffuses itself in the medium and does not reside in the growth itself. It is a brown shade and deepens gradually, becoming very dark brown after two or three weeks, and the growth itself taking on a brown tinge. This pigment is produced in agar, bouillon, Dunham's pepton solution, and coagulated blood serum but not in gelatine or upon potato. It is produced in alkaline, neutral and acid media and is inhibited by extremes of reaction as the growth itself of the organism is inhibited. It is produced at the room temperature. Higher temperatures inhibit the color faster than they do the growth.

Agar plate surface colonies are round, slightly convex, outline well defined, microscopically granular, after two days grumose

* Report Committee of Bacteriologists, Journ. Amer. Pub. Health Assoc., January, 1898.

near the center. Well-developed colonies are translucent and yellowish under the microscope by transmitted light. Colonies not crowded may reach 3 mm. in diameter before ceasing to increase. In bouillon a marked growth is visible after eighteen hours, without pellicle or clouding, the sedimenting white growth clinging to the sides of the tube. After ten or fifteen days the brown pigment makes its appearance, diffusing throughout the medium and the sediment takes on a dirty-brownish color. Gelatine is liquefied, the liquefaction in tubes at first crateriform or funnelform, but may become stratiform, reaching the walls of the tube and extending down horizontally. Occasionally the lower end of the stab liquefies the faster and produces a terminal sac of liquefaction. Blood serum is liquefied, with production after three or four days of the brown color, which becomes much darker with age than in old agar cultures. On ordinary acid potato no growth occurs. On neutral potato a very scanty growth takes place, becoming visible about the third day, not increasing after four or five days and never producing color. It grows abundantly in neutral milk, without coagulation, reaction unchanged or becoming slightly acid, the milk peptonizing and becoming nearly clear in from one to two weeks.

The optimum temperature is not far from 20°C. In the refrigerator between 3° and 6°C., no visible growth occurs, but the organism is not injured. A temperature of 31°C. inhibits somewhat the growth and of 37.5°C. arrests it entirely and the organism is killed by an exposure to it of seventeen hours. Bouillon cultures are sterilized by an exposure to 42°C. for ten minutes. A culture on a sealed agar slant was still alive at the end of seven months. The rate of growth and chromogenic property were markedly inhibited, but both were restored by repeated transfers.

In vacuo, by exhaustion with a Chapman pump and absorption of oxygen by pyrogallic acid and caustic potash a slight multiplication occurs, apparently due to a trace of oxygen at the beginning of the experiment. The growth does not increase and the organism is probably an obligate aerobe. It does not ferment glucose, lactose or saccharose, and does not produce indol, phenol, ammonia (in bouillon), invertin or diastatic ferments. It reduces nitrates to nitrites and finally to ammonia. Cultures in one per cent. glucose bouillon acquire an acidity or increase of acidity of 1.2 per cent to 1.6 per cent. in fifteen days, without production of the brown color; while in lactose or saccharose bouillon a very slight or no development of acidity occurs, and the pigment is produced much as in plain bouillon.

It is pathogenic particularly to the brook trout (*Salvelinus fontinalis*) and has been isolated from the Loch Leven (*Salmo trutta levenensis*) in epidemic, and in a few cases from the lake trout (*Cristivomer namaycush*). It has been found only in domesticated or aquarium fish and never in wild trout from the natural waters. It is not pathogenic to warm-blooded animals, and trout dead of the disease may be eaten after cooking, without harm.

After several months and repeated transfers on artificial media, it may slightly cloud bouillon, and exhibit a more pronounced Brownian movement to a degree suggesting motility. Attempts to stain flagella have had negative results, and the species is placed in *Bacterium* and named *truttæ* for the group of fishes that apparently contains its chief hosts.

M. C. MARSH.

U. S. FISH COMMISSION.

DISCOVERY OF A MUSK OX SKULL (OVIBOS CAVIFRONS LEIDY), IN WEST VIRGINIA, NEAR STEUBENVILLE, OHIO.

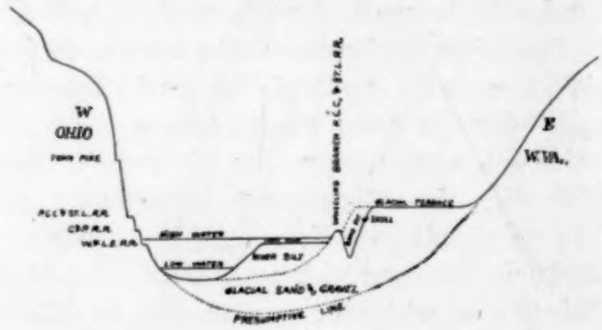
AT the fifty-first meeting of the American Association for the Advancement of Science, held in Pittsburgh, June 28 to July 23, 1902, Mr. Sam Huston exhibited a portion of the skull of a musk ox recently found near Steubenville, Ohio, at the same time making a verbal communication relative to the discovery of the specimen. Mr. Huston has lately sent to the writer for publication the following account of the finding of this skull, together with the accompanying sketch of a cross-section of the Ohio River valley at the point where the skull was found:

"The Glacial terrace in the vicinity of Steubenville, Ohio, consists of gravel and sand in varying proportions from fine sand up to small boulders of about six inches in diameter, the large proportion of the material, however, is from the size of wheat grains down. The material is partly derived from local rocks, but a large percentage, varying in different localities, is from the granitic and related material transported from the north of the lakes, the character of the latter being so distinctive as to convince geologists of its derivation as indicated above, and that it came from the grist of the glacier once covering the northern part of the continent. The material has been transported by water action from the farthest limit southward of the glacier, whose nearest approach to the locality under consideration was at Lisbon in Columbiana County, twenty-five miles northward.

"The terrace material is supposed to reach in places over one hundred feet in depth below high water of the Ohio River, and rises in the vicinity in places over seventy feet above low-water mark, or about thirty-five or forty feet above high water.

"The skull of the musk ox exhibited at the Pittsburgh meeting of the American Association for the Advancement of Science was found in the glacial terrace above described, the locality being on the West Virginia side of the Ohio, opposite and over one mile below Steubenville, Ohio, in the sand pit of the Steubenville Sand Co. on the Thomas Mahan farm, Brook Co., West Va., and at the east side of the Wheeling Branch of the P. C. C. and St. L. R. R. (Panhandle).

"The find consists of the major part of the skull, with brain cavity and portions of horn cores, and appears to be that of a musk ox. The skull was found by a laborer in the pit on the face of the talus slope, and therefore out of its original position. The contents of the brain and other cavities were the same as the terrace in general. The skull was first seen in the face of the slope of the pit above the level of the railroad, which is several feet above the highest level the river has ever reached since the vicinity has been inhabited by the whites. As any movement of the skull must necessarily have been downward, its original position before the sand was disturbed must have been well above high water, although the preservation of the skull must be held to indicate considerable covering, as it has lain for thousands of years in the terrace. The surface of the terrace is covered with a layer of clayey material that would be quite an element in the preservation of the skull. Near the position of the skull and under similar circumstances has since been found the nearly complete shoulder blade of a mammoth, which is now in my possession. The original position of the skull and shoulder blade as to geological horizon, was probably somewhat lower than that of the knife presented at the Springfield meeting of the American Association for the Advancement of Science, and found five miles below and on the opposite side of the Ohio River, but in the same glacial deposit. The accompanying sketch indicates the approximate cross-section of the Ohio River valley at the point under consideration."



I have examined with some care this skull, which, through the kindness of Mr. Huston, is now in the loan collection of this Museum. Only the posterior portion of it is preserved, and this appears to have pertained to a not very old though fully adult individual, as is evidenced by the nature of the sutures of the inferior region of the cranium. All that region anterior to the orbits is wanting. The zygomata and inferior processes (pterygoids, postglenoids, paroccipitals) are likewise broken away. The rounded and polished nature of many of the surfaces indicates that it was transported for some distance before becoming

finally imbedded in the terrace from which it was recovered after the manner detailed by Mr. Huston. The bones of the cranium are exceptionally heavy and massive, indicating that the skull pertained to an adult male. The frontoparietal surface is gently but regularly concave, the depth of the concavity being 18 mm. This surface is likewise very rugose. The horn cores are directed abruptly downward and a little inward distally, in so far as they are preserved. The extremities of both horn cores are wanting. The expanse of the horn cores equals but does not exceed that of the orbits. There are rather large frontal sinuses. These, as well as the various foramina, contain a considerable number of pebbles, nearly all of which are of local origin. Among them are two rather large fragments of coal. The character of the enclosed pebbles would seem to indicate that the specimen had not come much in contact with glacial detritus from the north.

The characters of the skull are such that I have no hesitancy in referring it to *Ovibos cavifrons* Leidy, first described by Dekay in 1828 as *Bos pallassi* in the *Annals* of the Lyceum of Natural History of New York. The chief interest attached to the present specimen comes from the additional evidence it affords as to the faunal changes brought about over this region during the glacial period. The remains of this animal have now been authentically reported from Fort Gibson, I. T.; St. Louis, New Madrid and Benton Co., Mo.; Trumbull Co., Ohio; Big Bone Lick, Ky.; from two different localities in Pennsylvania; and from Council Bluffs, Iowa and West Virginia. In every instance these remains have been recovered either directly from glacial deposits or from deposits that have been correlated with some stage of the glacial period. Since there would seem no good reason for assuming that the musk ox at that time preferred climatic conditions very different from those with which they are at present surrounded, the reasonable inference would seem to be that with the advancing ice they moved southward until their range reached an extreme limit averaging a few degrees, perhaps three or four, beyond the southern limit of the ice.

J. B. HATCHER.
CARNEGIE MUSEUM.

EXCEPTIONS TO MENDEL'S LAW.

DE VRIES, Correns, and some other writers have called attention to a number of apparently important exceptions to Mendel's law. In order to show the relation of these exceptions to the law, the law itself may be illustrated as follows: A and B are two plants, each of which is self fertile and which may be hybridized. Regarding any single respect in which these two plants differ, the resulting hybrid is a mono-hybrid. We will assume that the character B is recessive in the hybrid, representing the character by a small letter in cases where it is latent. The following diagram shows the results of hybridization, as far as the second generation.

		Pollen.		Ovules.	Types of plant produced.
Male parent A		A	×	A	A
	Ab	A	×	B	Ab
	(Hybrid)	B	×	A	Ab
Female parent B		B	×	B	B

This diagram shows that from the two kinds of pollen and two kinds of ovules produced by the hybrid plant Ab we get four fertilizations: A × A, which gives plants of the type of the parent A; B × B, which gives plants like the parent B; A × B and B × A, which give again the hybrid Ab.

It should also be stated that since each of these four crosses will occur an equal number of times according to the law of probabilities, the type A will constitute one fourth of the second generation, B one fourth, and Ab one half.

Mendel's law, as first stated independently in this country (Bul. 115, Off. Ex. Sta., p. 93) and essentially as stated by himself, is as follows: In the second and later generations of a hybrid there occur all the possible combinations of the characters of the parents, and in definite proportions.

But hybrids have been found in which this seems not to be the case. The explanation of a number of these is here offered. Millardet, De Vries, Correns and others report cases of

so-called false hybrids, in which in the second generation the hybrid splits up into the parent forms only. It is easily seen from what follows that this will necessarily be the case when two plants are crossed each of which responds to its own pollen more readily than to that of the other. Cases like this are not infrequent. Referring to the above diagram, we get the hybrid Ab in the first generation by offering to ovules of B pollen of A only. But when the hybrid produces pollen and ovules, both A and B ovules are supplied with both kinds of pollen; hence we get no hybrids in the fertilization of the ovules on the hybrid. That is, $A \times A$ and $B \times B$ give fertile seed and $A \times B$ and $B \times A$ fail because their ovules are supplied with both kinds of pollen and each responds more readily to its own than to that of the other. Instead, therefore, of being an exception to Mendel's law, Millardet's false hybrids fully conform to that law and are explained by it. Correns' proposed explanation of this case (See *Ber. Deutsch. Bot. Gesel.*, April 24, 1901) as a limiting case of a series, which is itself not satisfactorily accounted for, cannot be accepted.

Another case: sometimes a hybrid, instead of showing progeny made up of plants, one fourth of which are like the male parent, one fourth like the female parent, and one half like the hybrid, as is the case under Mendel's law, seems at once to be fixed in type, and produces progeny of its own type only. From what follows it will be seen that this is necessarily the case, if Mendel's law is true, when the two plants are each self-sterile or when each responds to the pollen of the other more readily than to its own, which is not infrequently the case. Referring again to the above diagram illustrating Mendel's law: $A \times A$ fails in this case because A ovules are offered both A and B pollen and they fertilize only with B pollen. Similarly, B ovules are offered both A and B pollen and they fertilize only with A pollen. We get therefore the fertilizations $A \times B$ and $B \times A$, both of which produce only the hybrid. Again we see that Mendel's law offers a perfectly rational explanation of what has been stated as an important exception to it. In this case I would suggest to those who are in a position to do so that the above explanations, which I present only as hypotheses as yet, may be easily put to test, by taking those cases in which these exceptional hybrids occur and ascertaining whether or not the hypotheses here proposed accord with the facts regarding the relative sterility of the plants towards their own pollen and that of the other party to the cross.

Many other apparently abnormal cases are to be explained on similar grounds; for instance, if one plant is self sterile or responds more readily to pollen of the other plant than to its own, while the other responds with equal readiness to both kinds of pollen, we would have a case like the following (see diagram): $A \times A$ would not occur, because A being offered pollen of both A and B, all the A ovules fertilize with B pollen. $A \times B$ and $B \times B$ will occur as in the diagram. $B \times B$ will constitute one fourth the progeny, while three fourths will consist of the hybrid Ab; such apparent anomalies are therefore entirely consistent with Mendel's law.

Some time in the near future I shall present another case which seems to be a real exception to this law (Correns' series above referred to) and shall offer an explanation for it and the results of experimental data.

W. J. Spillman.

Bureau of Plant Industry,
U. S. Dept. Agric.

A REALISTIC DREAM.

The following statement concerning a remarkably realistic dream was written in the form of a personal letter by Dr. Charles A. White to his friend Mr. Arnold Burges Johnson, of Washington, D. C.

A VISION.

My Dear Friend:

In compliance with your request I herewith send you an account of the visional dream to which I referred in our conversation a few days ago, together with some remarks upon it and upon certain circumstances connected with its occurrence.

During the five years from and after 1859, Rev. Dr. W. H. Barris and I were neighbors at Burlington, Iowa, and, owing to a common interest in geological and paleontological studies, our acquaintance become quite intimate. He frequently called upon me at my home to discuss our latest observations and discoveries, our region having been a remarkably favorable one for those studies. His calls were usually brief; his conversation was generally limited to the subjects referred to and to related topics, and I soon learned to admire him for his comprehensive knowledge, and to love him for his kindly nature. That association was broken by the removal of both of us to other places of residence, he going to the professorship of Greek and Hebrew in Griswold College at Davenport. There, also he continued his scientific studies, became one of the founders of the Davenport Academy of Sciences and, in due time, its president.

Our friendly acquaintance was continued by correspondence but after our separation at Burlington we seldom met. Indeed, so completely were we separated that I did not see him during the last thirty years of his life. I occasionally sent him copies of my publications, the receipt of which he acknowledged by letter, always in an appreciative manner. In 1900 I published two articles in SCIENCE, wherein I gave my views as to the proper construction and use of certain scientific terms derived from the Greek, and sent him a copy of each. I got no reply from him on that occasion, and some months afterward a letter from his daughter told me of his death, which occurred at Davenport, Iowa, on June 10, 1901. I was naturally grieved at the loss of my old friend, and, wishing to perpetuate the memory of so good a man, I wrote as appreciative a sketch of his life and character as I was able, and it was published at Des Moines in the *Annals of Iowa* for October, 1901.

Early in that month I received by mail at my home in Washington, D. C., a copy of the magazine containing the sketch and, after re-reading it, I went to my room to take my usual afternoon nap. Upon such occasions I frequently repeat to myself verses, or parts of poems, which I committed to memory in my youth. The rhythm and cadence have a soothing effect and I soon fall asleep. As I lay thinking of my friend I began repeating to myself Halleck's well-known lines:

> Green be the turf above thee,
> Friend of my early days.
> None knew thee but to love thee
> Nor named thee but to praise.

Just as I finished the last line I heard a voice on the further side of an arras near my bed which I recognized as no other than his own. I did not distinguish what he was then saying, but he seemed to me to be speaking to my wife, who had admitted him for a call upon me, just as she had often done in the old days. He then stepped into full view and I observed that he was dressed in his usual black walking suit and that he carried a book under his arm. After giving me a pleasant greeting he said archly, "Don't you think you rather overdid that sketch?" I knew he referred to the one I had written of himself and said quickly, "No, by no means." He replied, "Well I thought some persons might regard it as supererogatory." I said, "How can they? It is all true, and I wrote it in all sincerity." When he saw that I took the matter so seriously he, with his characteristic tact, at once changed the subject and said, "By the bye, I called to speak to you about the two articles you published in SCIENCE last year. I read them before I went away and ought to have written you about them, but I neglected it. You were quite right in your strictures upon the misuse of Greek words in the construction of scientific terms. That article was a grand, good thing." I replied, "That is indeed praise from one who taught Greek twenty-five years." "Well, that is what I thought of it," he said. Then, pausing as if he was thinking of something else, he said, "But I must be going," and moved away a little. I called out, "Don't go, Doctor, I have a lot of things I want to say to you." He turned and looked at me and said, "Yes, I must go"; and with a gentle laugh, just an audible smile, he was gone. His going so

agitated me that I rose quickly, fully awake, and so realistic had been my dream that for a time I could hardly believe that I had been asleep. Indeed, I think I had slept only a few moments, because I had not that feeling of lassitude which one has upon awaking from profound sleep. Wishing to preserve a record of such a strange dream I wrote out the foregoing account of it within a few hours after its occurrence.

The few dreams I have are usually of a perplexing and irrational character, and have little relevancy to any of my past or present waking experiences. But this one was visional in form, wholly pleasing, without irrelevant deflection, and entirely rational in character except that it involved an inconspicuous anachronism, the scene of the vision being laid for more than thirty years before the occurrences which formed the subjects of our conversation. That is, the personal appearance of my friend and my apparent surroundings were those of more than thirty years before, and not those of our later years, for he was nearly eighty when he died, we had long dwelt apart and in surroundings unlike those of our earlier years, and his latest photograph, since received, shows that he had a very different appearance in his later years from that which I saw in the visional visitation. But I did not observe that discrepancy then, and the visitation seemed entirely natural and purposeful.

I have always admired the definiteness of your faith and that of our friend H., in the future life, and I can well understand how it is that you are more disposed to regard my vision as an objective, than as a subjective, occurrence. Indeed, the dream was so distinctly visional in character that it is difficult for me to avoid taking the same view of it that you do, for even now the shadowy interview with my reverend friend seems as real to me as any that I ever had with him in the flesh. It was so pleasing that I can only regret that I have not had similar visional interviews with other departed friends, and that others whom he loved have not been thus visited since his departure. I am sure that I take less pleasure in a subjective than an objective view of my vision, but it is only proper that I should state the facts which favor the former view. I shall do little more than state those facts because I have never made myself familiar with psychic subjects.

When considering this vision subjectively reference must necessarily be made to my own physical and mental condition, but for the purpose of comparison it is necessary first to note the personal characteristics of the one whose shadowy form was the chief figure in it. I have already mentioned a part of them, but so far as they relate to the visional interview they may be summed up as follows: He was of an extremely genial disposition, although his manner in general was that of proper reserve. He was earnest but tactful in conversation and prompt to express approval of what he thought commendable. His usual garb was recognizably clerical, and he often carried a book or a small portfolio under his arm when he came to see me. His calls were often brief and sometimes closed abruptly, but always in a kindly manner. The expressions 'by the bye' and 'a grand, good thing' were habitual with him in conversation. All these characteristics, as well as his personal appearance and distinguishing tones of voice, were clearly brought out in the vision and made it harmonize completely with my distinct recollection of his personality, and of the many real interviews I had with him in those early years. It was really a composite representation of many of those interviews, and not a duplication of any one of them.

As to my own personality with reference to this vision it is perhaps enough to say that I am in good health although I am past the years of active life. My surroundings are congenial, and among my pleasantest memories are those concerning my early friends, most of whom I have outlived. I have written for publication biographical sketches of no less than six of them, but I have never received a visional call from any other than Dr. Barris; and I have never had a similar vision before or since. The sketch of his life before referred to was written while I was keenly sensible of the loss occasioned by his death, and while mentally reviewing his

admirable character, and it was plainly in connection with the state of mind thus induced that the vision occurred. I am, therefore, not surprised that he should have modestly suggested that that I had 'overdone' the sketch, but I could not then, and can not now, admit the correctness of that suggestion. His visional call upon me to acknowledge the receipt of the articles I had sent him was in exact accord with what he would surely have done if we were yet living as neighbors. His commendation of those articles may perhaps be regarded by some persons as a reflection of my own egotism; but I prefer to regard it as a reflection of my foreknowledge of what his opinion would be when he read them, and of his manner of expressing it personally.

Nothing is more common than the appearance of absent and deceased friends in dreams, but noteworthy features of the one here recorded are its coherence, congruity and absence of every unpleasant feature except the disappointment occasioned by the sudden termination of the interview. In these respects it was equal to any that I have ever known or heard of, and even Coleridge's vision of Kubla Khan was not more remarkable in those features. But Coleridge was in ill health when he saw that vision; my health was normal. His sleep and vision were estimated by himself to have been three hours long; mine was so short as to cause me to suspect that it was almost momentary. His vision was wholly fanciful; mine was a counterpart of ordinary interviews which actually occurred long ago. The chief subject of his vision was, in a sense, accidental; the chief subject referred to by my shadowy visitor was precisely that which he would have introduced had he been living. In short, it is the matter-of-fact character of this vision, coupled with the distinctness and long continuance of impressions caused by friendly intercourse that gives to it peculiar interest.

Faithfully yours,

CHARLES A. WHITE.

SMITHSONIAN INSTITUTION,
October 2, 1902.

RECENT ZOOPALEONTOLOGY.

A REMARKABLE NEW MAMMAL FROM JAPAN. ITS RELATIONSHIP TO THE CALIFORNIAN GENUS DESMOSTYLUS, MARSH.*

IN a recent number of the *Journal of the College of Science,* Imperial University, Tokyo, S. Yoshiwara and J. Iwasaki give a full and well-illustrated description of a remarkable fossil skull discovered in 1898 in apparently marine beds of Miocene age, in the province of Mino. Photographs and sketches of this skull were sent to the writer of the present notice about a year ago, the authors at the time referring the animal to the Sirenia; it seemed to the writer to present more resemblances to the Proboscidia, and this view is adopted by the authors.

A study of this more complete account of the fossil, and comparison with a supposed fossil Sirenian described by Marsh from California in 1888, under the name *Desmostylus hesperus,* lead to the belief that the reference of this animal at present is somewhat uncertain; it is possibly Proboscidian, it is possibly Sirenian. The possible community of origin of these two orders of ungulates was, in fact, suggested by De Blainville, and has received some support from the recent discoveries of ancient types of Mastodon and Sirenians in Egypt. The authors fully recognize the Sirenian as well as Proboscidian resemblances in this animal, and rightly conclude that these may be primitive characters due to the remote common ancestry of these two orders of ungulates.

Whatever its affinities, this new fossil mammal is certainly most remarkable. The skull is about eighteen inches in length; the upper and lower jaws are greatly produced anteriorly, as in the Proboscidia and Sirenia, the premaxillæ bearing two forwardly directed tusks, while the lower jaw bears two pairs of tusks—a larger outer incisor and a smaller median incisor. These tusks point forward, and are completely invested with enamel. The enamel is also extremely thick upon the grind-

* 'Notes on a New Fossil Mammal,' by S. Yoshiwara and J. Iwasaki, *Jour. of the Coll. of Science*, Imperial Univ. of Tokyo, Vol. XVI., Art. 6, 1902.

ing teeth, which consist of two rows of vertical columns or cylinders, quite separate above but uniting below into one or two roots. "The crown," the authors observe, "is an aggregation of long, cylindrical, column-like tubercles, which are generally arranged in two longitudinal rows, parallel to the longer axis of the crown, and in three tranverse rows at right angles to it. The enamel is extraordinarily thick, and the dentine, which occupies the center of the column, appears as a round section on the masticating surface." The authors conclude that the animal had four premolars and four molars [?] in the upper jaw, and four premolars and two or four molars in the lower; the number of teeth is rendered very uncertain, however, by the immature condition of this individual.

Marsh described the teeth of *Desmostylus* as consisting of nearly round columns loosely united, and more or less polygonal in cross section, thickly invested with enamel. He stated that the nearest affinities of this Sirenian are with the Tertiary *Metaxytherium* of Christol, and the living *Halicore*. The number of columns in a single tooth of *Desmostylus* is uncertain, but there are indications, according to Marsh, of at least twelve or fifteen. The *Metaxytherium* described by Christol (*Ann. d. Sc. Nat.,* 1841, Vol. XV., Series II., p. 333, Pl. VII.) was compared by him with *Hippopotamus medius* Cuvier ('Ossemens Fossiles,' Ed. 1825, Vol. I., pp. 333, 334, Pl. VII.); its molars are brachyodont or short-crowned, resembling those of *Hippopotamus* and not at all similar to those of *Desmostylus.* Dr. Matthew recently examined the *Desmostylus* teeth, and agreed with Professor Beecher that they are probably Proboscidian, belonging to the anterior part of the jaw of a young mammoth; somewhat similar teeth have been figured by Leidy in his later studies of the Florida mammoths.

Just as this notice was going to press, Professor John C. Merriam, of the University of California, kindly sent the following very interesting note, entitled 'The Geographic Range of Desmostylus Marsh': "Excellent figures of the teeth accompanying the text show the unknown form to be practically identical with the problematical *Desmostylus* of Marsh, which was described from several teeth and a few vertebræ obtained in California; the associated fauna is that of the Quaternary or the late Pliocene. Since the discovery of the type specimens, several teeth of *Desmostylus* have been found on this coast. The California State Mining Bureau has in its Museum a fine tooth from Canores Cañon, in the foothills of the west side of the lower end of the San Joaquin Valley. In the University of California Museum is a slightly worn tooth with a fragment of the jaw labeled San Jose. A third specimen, unfortunately of unknown origin, is in the Museum of the California Academy of Sciences. A fourth from Yaquina Bay, Oregon, is in the private collection of Professor Thomas Condon, at the University of Oregon. It is a matter for regret that we have not become acquainted with the exact occurrence of any of these specimens. Those from California appear to have come from fresh water beds of late Tertiary or Quaternary age. Regarding the tooth from Yaquina Bay, Professor Condon writes me: 'It was picked up on the Yaquina Beach which is throughout marine. * * * It was not the original finder who gave it to me so I missed the opportunity to learn whether it was loose on the surface or imbedded in the rock.'

"All of the teeth mentioned have the same structure as the type. In some of the American material there is practically a duplication of the form of specimens figured by Yoshiwara and Iwasaki. While a comparison of isolated teeth in forms so imperfectly known as these should hardly be considered as sufficient for indicating specific identity, there can be no doubt that the group represented by *Desmostylus hesperus* Marsh inhabited both the eastern and western shores of the Pacific. In all probability it will be shown to have had a much wider distribution than that now known."

The authors are certainly to be congratulated upon this discovery, which is one of the most important, if not the most important, paleontological discovery ever made in Japan.

EOCENE SIRENIANS IN EGYPT.

DR. C. W. ANDREWS published in July his third paper* on extinct vertebrates of Egypt, including a fuller description of a new species of Sirenian belonging to the genus *Eosiren*. The specialization of *Eosiren* is very notable. The author concludes: "It is remarkable that, except in the presence of posterior incisors and canines, this early (Middle Eocene) Sirenian is scarcely at all more generalized than the later *Halitherium*, and it appears that the Sirenia must have branched off from their parent stock at an extremely early period. In some respects, particularly in the structure of the teeth and of the humerus, there is a certain similarity with *Mœritherium*, and it seems not improbable, therefore, that the relationship between the Sirenia and the Proboscidea suggested by Blainville and others may have a real existence.

PROGRESS OF THE EXPLORATION FOR FOSSIL HORSES.

THIS is the second year of exploration by the American Museum of Natural History from the fund presented by William C. Whitney especially for researches on the evolution of the horse. Last year a number of Upper Miocene skulls and feet were found in Texas, but the chief discovery was the nearly complete skeleton of *Anchitherium*, the three-toed, marsh-living horse, which has just been mounted in the Museum. A nearly complete skeleton of *Mesohippus bairdi* was secured from a Western collector during the winter. The Montana expedition from the Museum during the present summer has fortunately secured a specimen of the little-known *Mesohippus westoni*, the horse of the Lower Oligocene, or Titanothere beds proper, a species first named by Cope from the Swift Current Creek region of Canada. Word has just been received of the very fortunate discovery in Nebraska of the remains of a small herd of *Hipparion*. They consist of one skull, which promises to be fine, parts of others, eight hind limbs and feet, mostly complete, four fore limbs and feet, one pelvis, and enough vertebræ and ribs to make up one complete vertebral column. Altogether there is no doubt that a complete animal can be mounted. The feet are of the very long, slender type, terminating in narrow, pointed phalanges.

* 'Extinct Vertebrates from Egypt,' III., *Geological Magazine*, N. S., Decade IV., Vol. IX., pp. 291–295, July, 1902.

THE PERISSODACTYLES TYPICALLY POLYPHYLETIC.

THE study of the fossil horses of this country, so far as it has progressed, proves conclusively that there were at least three and probably four parallel phyla, of which *Anchitherium*, *Protohippus* and *Hipparion* are the most conspicuous representatives in the Miocene, thus confirming results previously reached by Scott, Pavlow and others. This accords with the demonstration recently made by Osborn of four parallel phyla of Titanotheres, and of the long-known existence of two parallel phyla of Palæotheres. The theory that the Rhinoceroses included at least six parallel phyla is now finding fresh confirmation. The Lophiodons are certainly diphyletic, including the extremely light-limbed and the heavy-limbed forms. It thus appears that the Tapirs alone failed to conform to this law. This law is nevertheless a matter of comparatively recent recognition, the genealogy of the Horses, Rhinoceroses and Titanotheres having been widely treated as if they were monophyletic, ever since Huxley placed *Anchitherium*, *Hipparion* and *Equus* in a linear series.

H. F. OSBORN.

SCIENTIFIC NOTES AND NEWS.

DR. WOODROW WILSON was installed as president of Princeton University on October 25, in the presence of many distinguished educators and other prominent men. Addresses were made by ex-President Cleveland, by Dr. Francis L. Patton, the retiring president of the University, and by Dr. Wilson. We hope to publish the inaugural address of Dr. Wilson next week.

THE degree of LL.D. was conferred on Dr. Alexander Graham Bell at St. Andrew's University on October 23, on the occasion of the installation of Mr. Andrew Carnegie as rector.

AT the centennial celebration of the founding of Washington and Jefferson College, held

on the 15th inst., the degree of Doctor in Science was conferred upon Dr. W. J. Holland, the director of the Carnegie Museum in Pittsburgh, and upon Dr. John A. Matthews, of New York City.

A CENSUS of the Philippines will be taken on March 1. It will be under the direction of General Joseph S. Sanger, who will be assisted by Mr. Henry Gannett, of the Geological Survey, and Mr. G. H. Armstead, of the Department of Agriculture. They will leave for Manila without delay.

A BACTERIOLOGICAL laboratory has been created by the Prussian government at Potsdam and placed under the charge of Dr. Behla, known for his researches on cancer.

MAJOR W. C. GORGAS, surgeon, U. S. A., has been designated by Surgeon-General O'Reilly to represent the United States at the First Egyptian Medical Congress which opens at Cairo on December 16.

DR. JAMES BRYCE will give at Cambridge University on November 29 the first of the Henry Sidgwick memorial lectures. His subject is 'The Philosophic Life among the Ancients.'

PROFESSOR ERB, of Heidelberg, known for his work on the nervous system, gave last month the inaugural address of the winter session of the Post-graduate College of the West London Hospital.

IT is announced that lectures will this winter be given before the Royal Geographical Society by Captain Otto Sverdrup on his four years' Arctic work in the *Fram,* and by Dr. Sven Hedin on his three years' expedition to Central Asia.

DR. HANS FRIEDERICH GADOW, lecturer on zoology at Cambridge University, has passed through the United States on his way home from an expedition to Central America.

CAPTAIN BOYD ALEXANDER has recently left England to pursue his ornithological investigations in the island of Fernando Po and other places in the Bight of Benin; and he intends to explore the country around Lake Chad, in order to acquire further knowledge as to the affinity existing between the West African and East African fauna.

DR. MAX WOLF, director of the Observatory at Heidelberg, Germany, has appointed Mr. Raymond S. Dugan his assistant for one year, on the recommendation of Professor Todd, whose pupil and assistant at Amherst he formerly was. For the past three years Mr. Dugan has had charge of the Beirût Observatory, which was built for the Syrian Protestant College by D. Stuart Dodge, Esq.

PROFESSOR HUGO KAHL, formerly of the faculty of the University of Kansas, and latterly connected with the Agricultural Experiment Station of the University of Illinois, succeeds Mr. Herbert H. Smith as a custodian in entomology at the Carnegie Museum, under Dr. W. J. Holland, the curator of that department.

THE council of the British Institution of Civil Engineers has, in addition to the medals and prizes given for communications discussed at the meetings of the institution in the last session, made the following awards in respect of other papers dealt with in 1901–02: A Telford gold medal to J. McFarlane Gray (London); a George Stephenson gold medal to R. Price-Williams (London); a Watt gold medal to W. Bell Dawson, M.A., D.Sc. (Ottawa); Telford premiums to W. R. Cooper, M.A., B.Sc. (London); E. M. De Burgh (Sydney, N. S. W.); George Wilson, D.Sc. (Manchester); Frank Oswell, B.A. (Buenos Ayres); A. W. Brightmore, D.Sc. (London); a Crampton prize to C. D. H. Braine (Mowbray, Cape Colony); the Manby premium to B. W. Ritzo (Cape Town).

IT is proposed to create a memorial to Professor Virchow in Great Britain, the movement having been inaugurated by Lord Lister.

PROFESSOR SYDNEY H. SHORT, formerly professor in Denver University, known for his researches in electricity, has died in London, at the age of forty-four years.

THE International Congress of Americanists held last week its fourteenth session at the American Museum of Natural History, New York City. The program contained the titles of ninety-two papers contributed by dis-

tinguished representatives from Europe, South America, Mexico and the United States. We hope to publish shortly a full account of the proceedings.

THE International Congress on Tuberculosis opened in Berlin on October 23 with about one hundred delegates in attendance. Professor Brouardel, of Paris, was chosen chairman. The press despatch quoted by us last week that Dr. W. H. Welch was one of the American delegates may have been correct as far as the appointment is concerned, but Dr. Welch has returned to Baltimore after delivering the Huxley lecture at London.

THE seventh International Congress of Agriculture will be held at Rome in the spring of 1903. It will be divided into ten sections. (1) Rural economy, agrarian and land credit, cooperation, insurance, international commercial relations. (2) Agronomy (application of science to agriculture, amelioration of agriculture and pasturing). (3) Agricultural instruction (schools, colleges, agricultural experiment stations, etc.). (4) Economy of farm animals and related industries (bees, birds, silkworms, etc.). (5) Rural engineering (construction, hydraulics, etc.). (6) Special culture and related industries (fecula, oil, sugar, fruit, vegetables, flowers, essences, etc.). (7) Vegetable pathology, destruction of parasites, protection of useful animals (international measures). (8) Forests (preservation, replanting, etc.). (9) Water and pisiculture. (10) Wine growing and making. This special section will be considered as a continuation of the International Congress of Wine Growers inaugurated in Paris in 1900.

THE collection of the birds of Holland, formed by Baron Snouckaert van Schauburg and mounted by Tar Meer, the celebrated Dutch taxidermist, has been purchased by the Carnegie Museum. It numbers about eight hundred specimens and contains nearly all the species of Western Europe. Each species is represented by both sexes in adult plumage, and in many instances by the young also. There are over three hundred species found in the collection. The collection of the lepidoptera of Western Pennsylvania made by Mr. Henry Engel, of Pittsburgh, has also been purchased by the museum. It contains nearly twelve thousand specimens, representing approximately two thousand species. The specimens are in beautiful condition.

IT is announced that the entomological collection of the late John Ackhurst, of Brooklyn, containing some 50,000 specimens, has been purchased for the zoological department of the University of Chicago.

MISS MARY H. TATNALL has presented the herbarium of her father, the late Edward Tatnall, to Colorado College.

MR. JOHN MORLEY has given the library of the late Lord Acton to Cambridge University. It will be remembered that this valuable historical library of some 70,000 volumes was purchased some time ago by Andrew Carnegie from Lord Acton, who was allowed to retain it until his death. Upon Lord Acton's death Mr. Carnegie gave the library unconditionally to Mr. Morley.

THE expeditions sent by the Carnegie Museum to the fossil fields of the west report unusual success during the past summer and fall. Mr. W. H. Utterbach has succeeded in recovering in Wyoming a nearly complete skeleton of diplodocus in beautiful condition, as such things go. The bones are free from crushing and the matrix is of such a character as to enable them to be easily freed from their surroundings. Mr. O. A. Peterous and Mr. C. W. Gilmore were very successful in their labors in western Nebraska and eastern Wyoming, where they made considerable collections of mammalian remains. Mr. Earl Douglas in Montana has had excellent success. Some four or five weeks ago he reported that he had already taken up fifty-eight skulls, accompanied by more or less complete skeletons, representing the peculiar fauna of the deposits in which he has been working. Mr. C. W. Gilmore, who has been working in the Freezeout mountains of Wyoming, has collected a large quantity of material representing the carnivorous dinosaurs, hitherto lacking in the collections at the Carnegie Institute.

MR. H. J. EUSTACE sends notice from the New York Agricultural Experiment Station

at Geneva that an unusual and serious trouble with harvested apples has appeared in western New York. It is confined entirely to scabby apples. A white or pinkish mildew appears upon the scab spots and transforms them into brown, sunken, bitter, rotten spots. On very scabby apples these rotten spots soon coalesce and ruin the fruit. The damage done is enormous. In Niagara, Orleans, Monroe and Wayne counties thousands of barrels of apples have been ruined. The varieties most affected are Greening and Fall Pippin. Upon investigation it was found that the white mildew on the scab spots is the cause of the rot, and that it is a distinct fungus having no connection with the scab fungus. The scab itself will not rot a fruit, but it breaks the skin wherever it grows and thereby makes an opening for this other fungus to get into the apple and rot it. Traces of the rot are sometimes found upon apples while still on the trees, but the greatest damage is done during the sweating process, either in piles on the ground or in barrels. Apples barreled immediately after picking and placed at once in cold storage seem to escape the trouble, but it is liable to appear later when the fruit is placed upon the market. A preventive of the rot is much to be desired, but at present none is known. Investigations in this line are now in progress at the station. The whole trouble can be traced back to a lack of thorough spraying. Had the apples been kept free from scab by spraying, the white rot fungus could do them no harm in storage. However, the past season has been exceptionally favorable for scab and spraying has been less effective than usual.

The College of Physicians of Philadelphia announces that the next award of the Alvarenga prize, being the income for one year of the bequest of the late Señor Alvarenga, and amounting to about $180, will be made on July 14, 1903. Essays intended for competition may be upon any subject in medicine, but can not have been published, and must be received by the secretary of the college on or before May 1, 1903.

It is said that the commission appointed by the New York Legislature to report on the plans for establishing a state electrical laboratory at Schenectady, consisting of State Engineer Bond, A. C. Buck, of Niagara Falls, and C. P. Steinmetz, of Schenectady, will report favorably on the plan.

The Electrical World states that it is proposed to use electric light signals at night and flags by day to warn the fruit growers of the Santa Clara Valley as to the approaching weather conditions. Professor A. G. McAdie, of the Weather Bureau, at San Francisco, has suggested that during the months of February, March and April the orchardists be warned by colored lights of the approach of frosts, which would enable them to smudge by burning oil, etc. During September, October and November the approach of showers could be indicated. An electric tower, 220 feet in height, located in San Jose, Calif., can be seen over the greater part of the county.

The volume containing the physical papers of the late Professor Henry A. Rowland, the preparation of which for publication we have already announced, is now nearly ready for distribution to its subscribers. It has been edited under the direction of a committee, consisting of President Remsen, Professor Welch and Professor Ames, who have made every effort to present to the world, in a suitable form, this memorial of their colleague. In this book, which contains about 750 pages, royal octavo, are collected not alone Professor Rowland's strictly scientific papers and his public addresses, but also a detailed description of his ruling engine, with plates and photographs. The memorial address of Professor Mendenhall serves as a biographical sketch, which is accompanied by a portrait of Professor Rowland. The subjects treated in these papers cover a wide range. In heat there is the great memoir on the mechanical equivalent of heat, with several shorter articles on thermometers. In electricity and magnetism there are the fundamental researches on magnetization, on the magnetic effect of electrical convection, on the value of the ohm, on the theory and use of alternating currents, etc. In light there are the renowned discovery and theory of the concave grating and the long series of investigations made in the field of

spectroscopy. Lists of wave-lengths will not be reprinted in this volume, as they are readily accessible elsewhere; and any subscriber to this volume may obtain, by application to the Johns Hopkins Press, Baltimore, a copy of Rowland's 'Preliminary Table of Solar Wave-Lengths.' The price set is five dollars net per copy for orders sent in advance of publication, after which the price will be $7.50. Orders may be sent to Professor Joseph S. Ames, Secretary of the Committee of Publication, Johns Hopkins University, Baltimore, Maryland.

THE board of visitors to the Melbourne Observatory in their report to the Governor of Victoria express their regret that the position of chief assistant has not yet been filled, "for it has become more and more urgent from the fact, among other reasons, that new and important duties will shortly devolve on the astronomer in connection with the bureau of standard weights and measures, which, we are informed, is to be placed in Mr. Baracchi's charge. Mr. Baracchi's predecessor always had two trained astronomers as assistants, but now what was formerly the work of three men falls entirely on his shoulders. All the present staff except Mr. Baracchi are either observers or computers, each doing the work he has been trained to do accurately and well, but among them all there is no one competent to take charge of an observatory even for 24 hours. The observatory, one of the most important in the Southern Hemisphere, is primarily a place for astronomical research, and its existence can only be justified by research work carried on in it. Mr. Baracchi has already proved himself to be eminently qualified to conduct astronomical research, but he is practically unable to attempt such investigations, as his time is more than fully occupied with the routine work of administration and detail that could equally well be done by a chief assistant. We cannot expect the reputation of our observatory to be maintained if we compel the director to spend his time conducting correspondence, arranging details of the work, supervising computers, and travelling about the country inspecting barometers and rain-gauges."

A SPECIAL sub-committee of the Technical Education Board of the London County Council has recently published a report on 'The Application of Science to Industry.' The *Electrical World* states that the committee has arrived at the conclusion that "various branches of industry have during the past 20 or 30 years been lost to this country, owing to the competition of foreign countries; that in many others our manufacturers have fallen seriously behind their foreign rivals; and that these losses are to be attributed in no small degree to the superior scientific education provided in foreign countries." In this connection, reference is made to the transfer from England to Germany of numerous departments of manufacturing chemistry, the best-known instance of loss being the manufacture of aniline dyes and many other valuable products from coal tar. Whereas the original investigations and discoveries on which the industry is based were made almost entirely in England, there are not now a thousand workpeople employed in the industry in the Kingdom. On the other hand, it is a most lucrative and flourishing business in Germany. Then the manufacture of high-class lenses for photographic cameras, microscopes, telescopes and field-glasses, as well as of thermometer-glass tubes for making thermometers for accurate physical measurements, has practically been lost to the country. Thirdly, the committee points to the rapid development in the United States, Germany and Switzerland of the various branches of the manufacture of electrical machinery, as compared with the relatively slow progress made in the United Kingdom. In 1890 the imports of electrical appliances and scientific apparatus were too insignificant to be separately scheduled. In 1900 they amounted to £1,174,000 and £522,000, respectively. While some of the witnesses examined attributed the relative backwardness of England in scientific industries partly to other causes, they were practically all agreed in considering it due, in the main, to the deficiencies of the British educational system. It did not appear that the training of the workmen was at fault. It is believed that the opportunities now open to the Lon-

don workman for obtaining technical education in his trade are actually superior to those enjoyed by the German or American workman. Summing up all the evidence, the committee is convinced that the main causes of British failure in the chemical, optical and electrical industries are the following: (*a*) The lack of scientific training of the manufacturers themselves, and their consequent inability to recognize the importance of scientific assistance; (*b*) the defective condition of secondary education, and the consequent lack of sufficiently prepared recruits for advanced technological training; (*c*) the lack of a sufficient supply of young men who have been trained, not only in scientific principles and method, but also in the application of science to particular industrial processes; (*d*) the lack of any institution providing advanced technological training which is sufficiently equipped and endowed to enable it to give adequate attention to post-graduate or advance work. There is a consensus of opinion that the highest grade of technical education must be carried on in an institution of university rank during the day. The few hours which can be given in the evening by those who are engaged in business during the day are insufficient for training in research.

UNIVERSITY AND EDUCATIONAL NEWS.

MR. JOHN D. ROCKEFELLER has offered to give $500,000 to Teachers College, Columbia University, on condition that the sum of $440,000 be collected from other sources—$190,000 to pay the outstanding debts and $250,000 for further endowment. It was also announced at the meeting of the trustees on October 23 that the college had received from Mr. and Mrs. B. Everett Macy $175,800 for the increase of the endowment funds and $98,709 for the completion of the Horace Mann School.

PRINCETON UNIVERSITY has been made the residuary legatee under the will of the late Mrs. Susan Dod Brown, and will, it is said, receive $140,000.

AT a meeting of the governors of University College, Liverpool, on October 14, it was announced that the sum of £170,000 had been promised for the endowment of an independent university when created.

LEIPZIG UNIVERSITY will celebrate the five hundredth anniversary of its establishment in 1909.

THE following is a list of appointments in the Scientific Departments of the University of Maine for the present year: Perly F. Walker (University of Missouri, Cornell), professor of mechanical engineering; J. E. Burbank (Bowdoin, Harvard), instructor in physics; Walter Rantenstrauch (University of Missouri), instructor in mechanical engineering; F. H. Mitchell (University of Missouri), instructor in chemistry; H. W. Britcher (Syracuse and Johns Hopkins), instructor in zoology; W. A. Mitchell (Trinity), tutor in physics; H. E. Cole (University of Missouri), tutor in electrical engineering; T. Buck (University of Missouri, Chicago), tutor in mathematics; W. A. Lambert (Harvard), tutor in mathematics; H. H. Hanson (Pennsylvania State College), assistant chemist in experiment station; H. P. Hamlin (University of Missouri), assistant in civil engineering; C. C. Alexander (University of Missouri), assistant in civil engineering.

MISS ALICE W. WILCOX, B.A. (of Vassar), and for two years fellow at Chicago University, has been appointed instructor in zoology at Wellesley College. Miss Frances E. Foote, B.A., of Wellesley College, and lately graduate student at Columbia University, has also been appointed to a partial instructorship. These additions to the department are made necessary partly by increase in number of students and partly by the fact that Miss Mary A. Bowers, senior instructor in the department is this year doing but half work.

M. LIARD has succeeded M. Gréard as vice-rector of the University of Paris.

MR. R. P. GREGORY, of St. John's College, has been appointed demonstrator in botany at Cambridge University.

DR. H. W. THOMAS, of Montreal, has been appointed fellow in pathology at McGill University.